PVP

PAINT and VARNISH PRODUCTION

Continuation of industrial finishes on an obsolescence-creative cycle is discussed by M. A. Glaser, Midland Industrial Finishes, shown with Lab Head E. J. Bromstead. (P. 56)

APRIL 1961

Modern Nitrocellulose Furniture Finishes...p.33

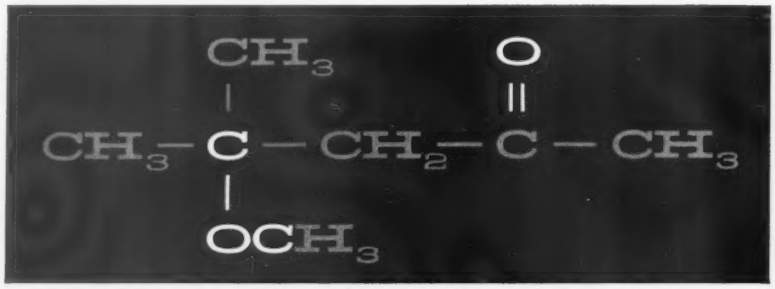
PVP

BULLETIN:

Comparative data on Shell Chemical's high boiling Pent-Oxone* solvent promises lower costs on vinyl lacquers

Pent-Oxone solvent is a keto-ether. It is a remarkable new compound of this class of chemical which gives you double solvent action plus high diluent tolerance for use with a wide range of lacquer resins.

Read how Pent-Oxone solvent compares with other high boiling vinyl solvents in evaporation and viscosity, what it costs, and where it is finding new applications in and out of the coatings industry.



Solvent action in glycol ethers comes from the COC ether linkage. In ketones, the double bond oxygen does the work. Shell Chemical's Pent-Oxone is the only commercially available solvent with *both* these functional groups.

BECAUSE it combines the solvent properties of ketones and glycol ethers in one molecule, Shell Chemical's new Pent-Oxone gives you greater solvent potential than any other type of high boiler.

This potential can often save you money. In vinyl lacquers, Pent-Oxone can replace high boilers costing 40¢ to $1.10 more per gallon.

Comparative evaporation data

Pent-Oxone is in the high boiling class with an evaporation rate comparable to cyclohexanone and EGMEE acetate. Comparisons with cyclohexanone and isophorone in seconds are as follows:

Per Cent evap.	cyclo-hexanone	Pent-Oxone	iso-phorone
10%	180	231	2600
30	560	715	8300
50	940	1200	14200
70	1330	1680	20600
90	1720	2175	27600
95	1825	2310	29500
100	2120	2450	34000

Comparative viscosity data

The following viscosity comparisons are taken after one hour on a 50/50 solvent/toluene mixture with the indicated Vinylite** resin:

10% VYNS-3	Pent-Oxone	93 cps.
	cyclohexanone	54 cps.
20% VMCH	Pent-Oxone	125 cps.
	cyclohexanone	142 cps.
	isophorone	260 cps.
20% VYHH	Pent-Oxone	310 cps.
	cyclohexanone	232 cps.
	isophorone	285 cps.
20% VAGH	Pent-Oxone	500 cps.
	cyclohexanone	320 cps.
	isophorone	405 cps.

With VAGH/Pent-Oxone solvent, viscosities rise with time. This can be overcome by using 50/50 Pent-Oxone solvent/cyclohexanone as the active solvent. Such a mixture would save you 55¢ per gallon against using cyclohexanone alone.

Better odor, lower cost, many uses

The price of Pent-Oxone is 17.5¢ per pound delivered in tank cars. It can tolerate up to 70% diluent in vinyl chloride/vinyl acetate copolymer solutions. It has a better odor than other vinyl solvents and is proving valuable in vinyl adhesives as well as acrylic lacquer thinners.

In nitrocellulose lacquers, Pent-Oxone retards blush, dries in reasonable time. It acts as a coupling agent in sludge removing compounds.

Complete data and samples

For samples and information, including complete graphs on viscosity and evaporation, write or call any of Shell's 9 Industrial Chemicals Division offices, or write Shell Chemical Co., 110 W. 51 St., New York 20, N. Y.

Do it today. Start investigating Pent-Oxone's remarkable keto-ether action for yourself.

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A Bulletin from

Shell Chemical Company

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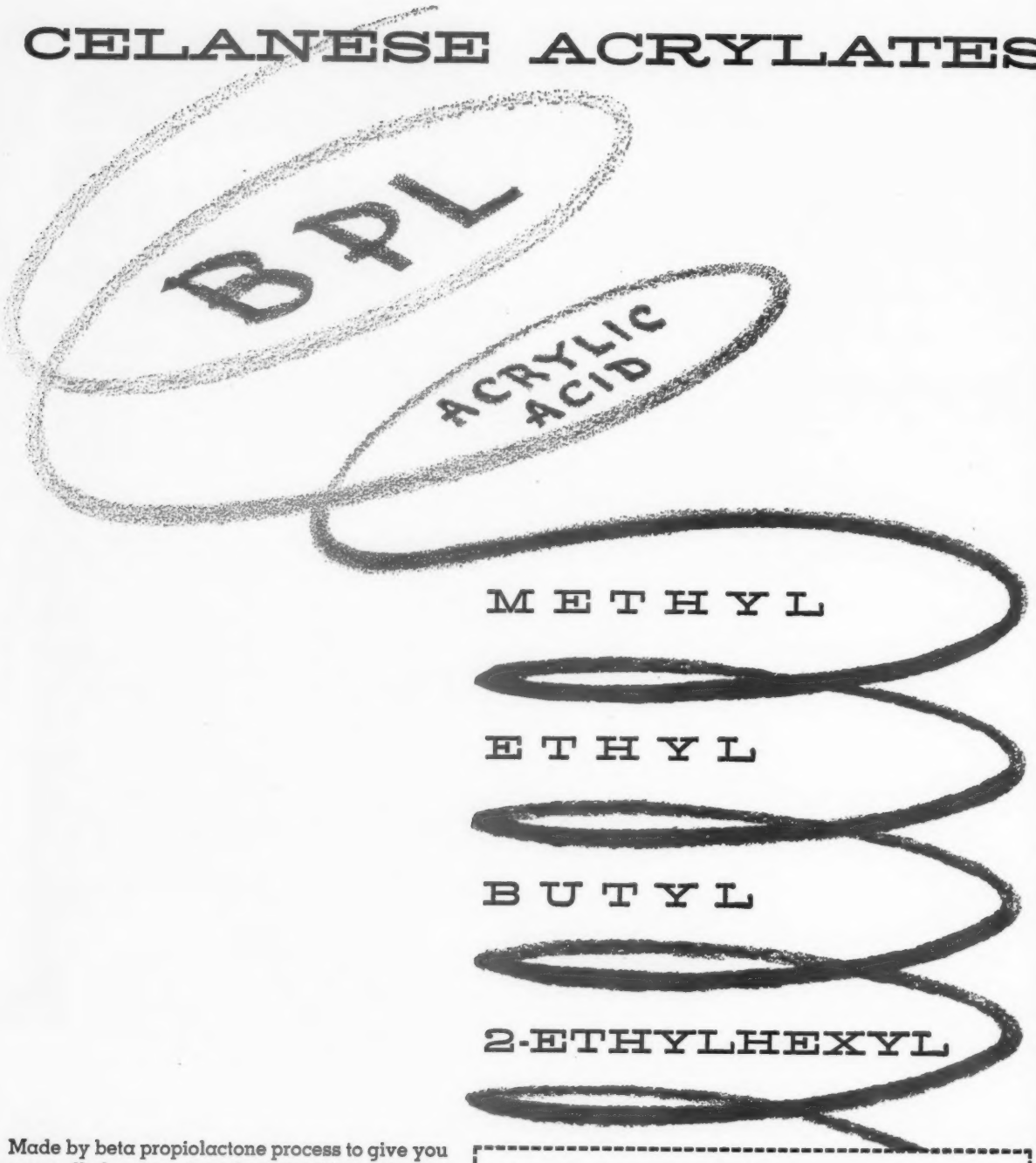

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PAINT and VARNISH PRODUCTION

(REG. U.S. PATENT OFFICE)

APRIL 1961

Formerly PAINT and VARNISH PRODUCTION MANAGER

(Established in 1910 as The Paint and Varnish Record)

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NO. 5

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PAINT and VARNISH PRODUCTION is published monthly except semi-monthly in March at Easton, Pa., by Powell Magazines, Inc., John Powell, president; Ira P. MacNair, vice-president and treasurer; Alan P. Danforth, vice-president; Alice L. Lynch, secretary. Entered as second class matter at Post Office at Easton, Pa., Jan. 30th. 1952, under the Act of March 3, 1879. SUBSCRIPTION RATES POSTPAID: *United States and Canada*, 1 year $4.00; 2 years $7.00. *Mexico and Pan-American Countries*, 1 year $5.00; 2 years $8.00. All other countries, 1 year $8.00; 2 years $15.00. Remit cash in advance, with order, by bankers draft on New York funds. SINGLE COPIES: *Current issue:* $0.50; *all back numbers:* $1.00. Convention issue: $1.00. Review and Buyers' Guide: $5.00. Bound volumes: $15.00 per vol. when available. We cannot guarantee to supply back numbers and claims for missing numbers cannot be granted if received more than 60 days after date of mailing. Subscribers should promptly notify circulation department of any change in address, giving both old and new addresses and by sending address label. EDITORIAL AND EXECUTIVE OFFICES: 855 Avenue of the Americas, New York 1, N. Y. BRyant 9-0497. Printed in U. S. A.

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EDITORIAL COMMENT

Advance Study is Important

RESEARCH-minded technical men in chemical and related industries are urged by Dr. A. C. Zettlemoyer, Distinguished Professor of Chemistry at Lehigh University, to broaden their spheres of knowledge through advanced study.

"Gone are the days when progress could be made on old-fashioned string and bailing wire stop-gap methods," said Dr. Zettlemoyer. He went on to cite that electronic computers, high speed photography, and other scientific advancements are being resorted to more and more to solve basic problems upon which technical progress in many fields depends. In addition, bigger roles are being played by classical physical chemistry tools, such as measurements of light scattering, heats of wetting, radiotracers, etc.

Yes, bigger roles are being played by classical physical chemistry tools.

A case in point is the development of a new test procedure involving a specially-equipped infrared spectrophotometer which measures the degrading effects of ultraviolet light on paint materials.

The method was explained by Don A. Hilliard, head of the paint section in the Chemical Division of the Goodyear Tire and Rubber Company, at a recent meeting of the New York Society of Paint Technology. He pointed out that this new test method allows a more accurate evaluation of molecular and chemical changes caused by outdoor exposure than was possible with previous techniques. But of particular importance is that this new method can reduce years of testing to a matter of weeks or months.

One result of this speed up in evaluation has been the development of a styrene-acrylate resin that resists ultraviolet degradation, Mr. Hilliard reports. It is interesting to note that pigments can play an important part in improving the resin's ability to withstand ultraviolet light. White paints with a 50 per cent or more pigment volume concentration are very durable. Zinc oxide and barium metaborate were found to be good ultraviolet absorbing pigments, according to Mr. Hilliard.

To explore the mechanism of ultraviolet degradation required a special knowledge of spectrophotometry which could only be obtained through advanced studies. Results of this investigation have contributed, and will continue to contribute toward better paint binders for exterior application. For the paint industry, this represents progress.

However, Dr. Zettlemoyer notes that a major problem facing universities today is their inability to attract qualified men to undergo such advanced study, because of the lure of initial high salaries paid by industry. Yet the long term advantages of advanced study cannot be over-emphasized in any scientific field, whether it be coatings or medicine.

Thank You Dorothy

PAINT, paint says Dorothy!

One of our foremost decorators, Dorothy Draper in a recent column of the New York *Journal American*, urges everyone to get on the bandwagon, because this is the year to paint.

Dorothy suggests re-painting that almost-black mahogany bed which belonged to Grandma in white, and you'll be surprised at the results.

"Please don't think antiques are too sacred to paint," she says.

Dorothy was impressed over the sandstone facade on one of the popular Fifth Avenue stores in New York which was painted in charcoal gray with great white wooden shutters and red and white stripped awnings. This was quite a departure, since painting sandstone is almost unheard of, but to Dorothy sandstone is a "nothing color."

Hail Dot, more power to a wise lady who knows what paint can do.

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Published monthly by
POWELL MAGAZINES, INC.
855 Ave. of the Americas
New York 1, N. Y.
BRyant 9-0497

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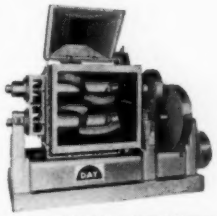
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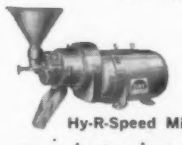
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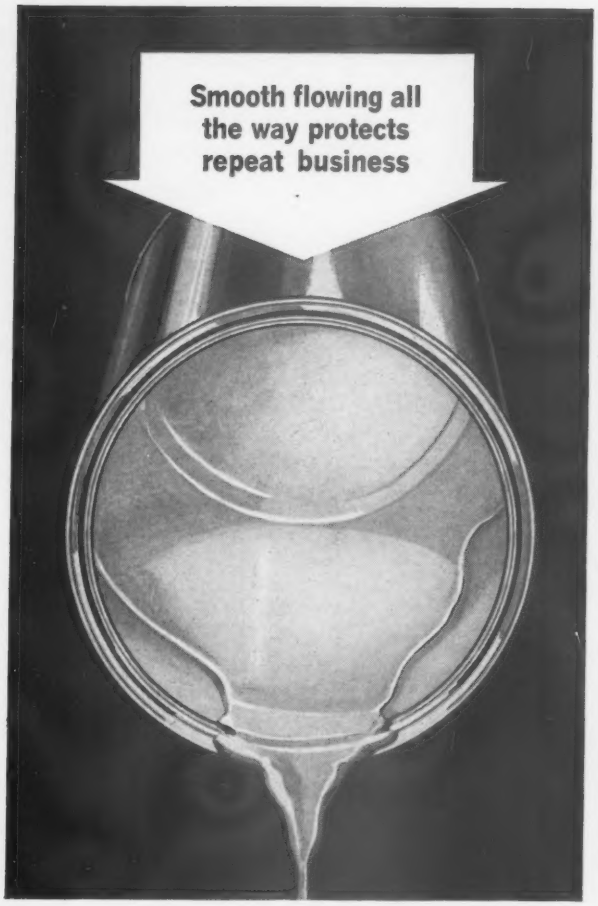

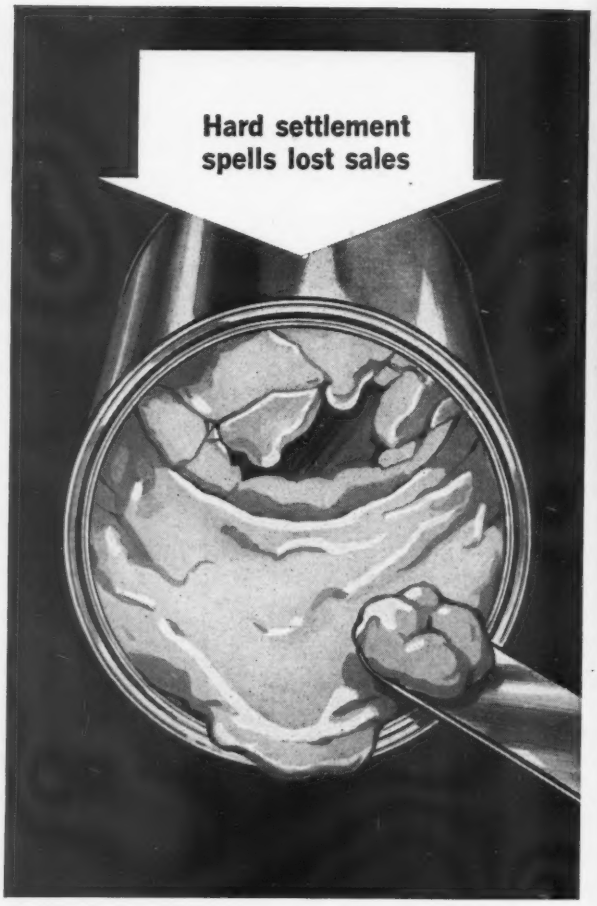

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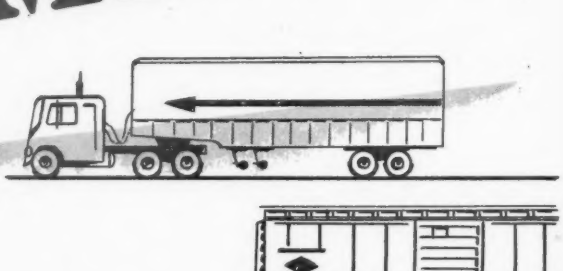

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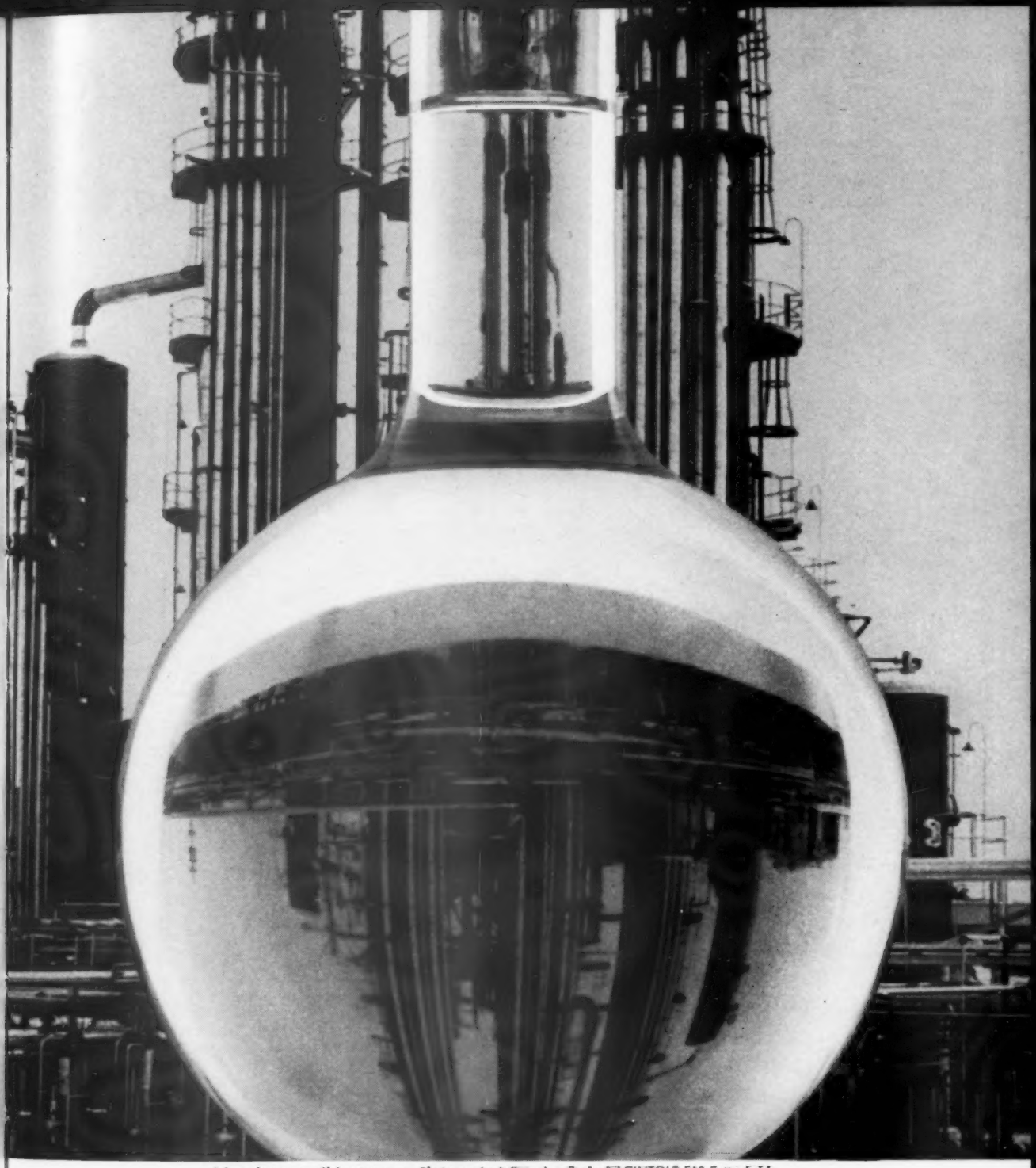

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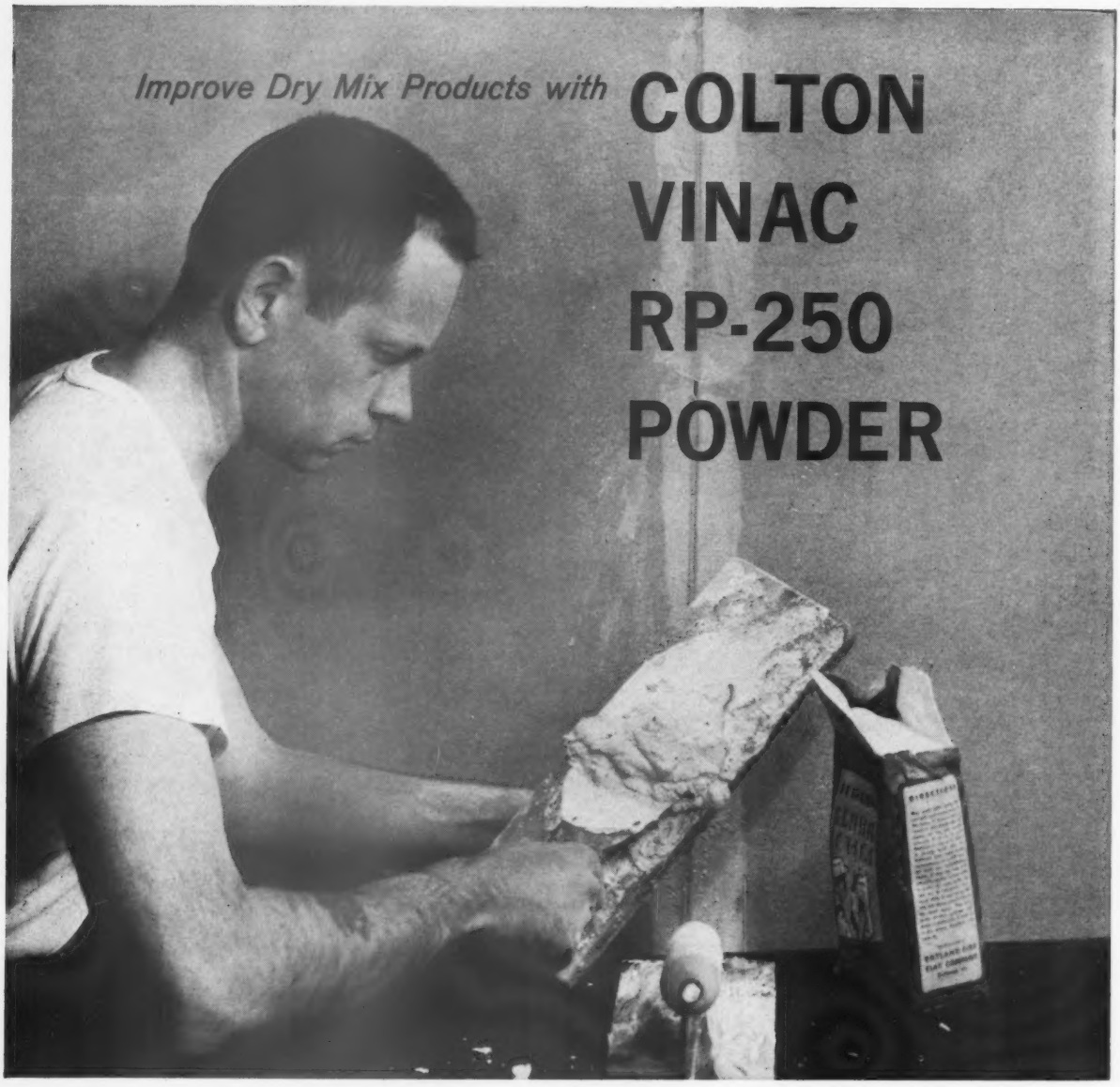

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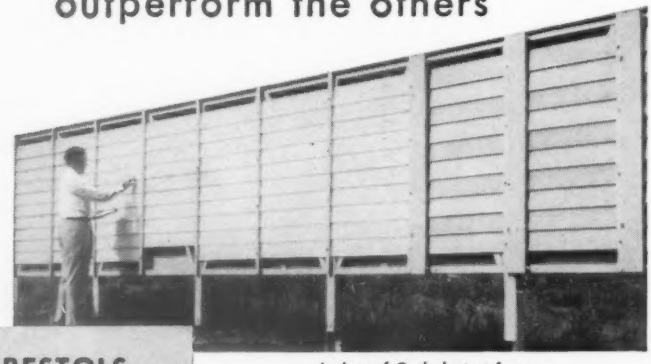

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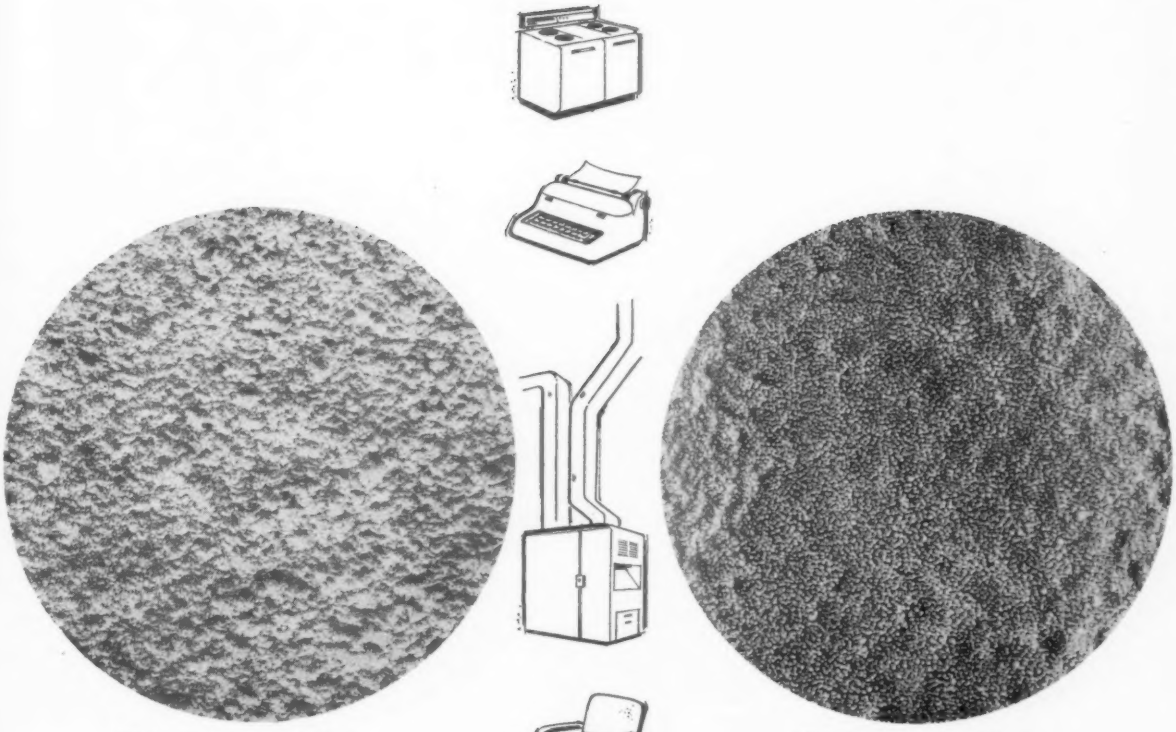

This finish contains quality controlled Plaskon Coating Resin

This finish contains ordinary coating resin

Compare these two unretouched photographs of hammertone finishes on "24 gauge" steel panels. Notice the more uniform pattern and freedom from mottling in the finish on the left. It is made with quality controlled Plaskon Coating Resin. Poor quality raw materials can cause the blotchy, irregular appearance so obvious in the right hand panel.

Quality control checks are run on Plaskon Coating Resins throughout their manufacture . . . from selection of raw materials to finished resins. True . . . this extra care and attention costs a little more . . . but measured in terms of customers' satisfaction it is a shrewd investment. More details? Drop us a line.

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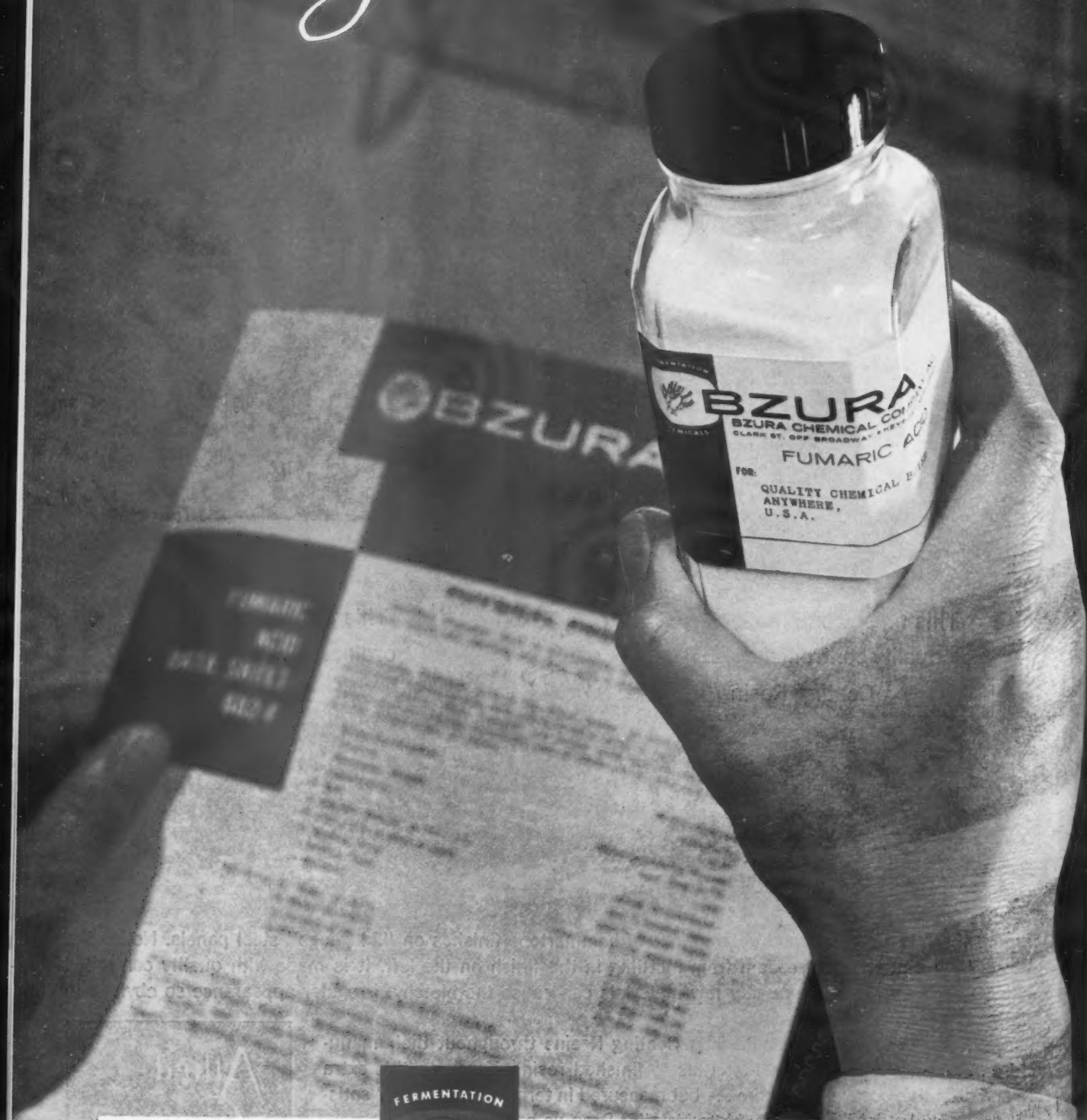

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EPOXY ESTER COATINGS upgraded by dimer acid

Substitution of Empol 1022 Dimer Acid for a portion of the fatty acid modifier in epoxy ester coatings improves viscosity, caustic resistance, water resistance, through-dry, hardness, color retention, and flexibility. As an example, the table at the right shows the degree of improvement obtained in a test formulation made with a high I.V. liquid vegetable fatty acid. Formulations based on other proportions and other fatty acids should respond similarly.

This use in epoxy ester coatings is but one application of Empol 1022 Dimer Acid in the Surface Coatings Industry. Its unique composition (a mixture of 75% C_{36} dibasic and 22% C_{54} tribasic long-chain acids) makes it an unusually interesting material in many types of surface coatings. For product data and an experimental sample, write Dept. X-4.

ORGANIC CHEMICALS DIVISION,
Emery Industries, Inc.
Carew Tower, Cincinnati 2, Ohio

The extent to which 1022 can achieve improvements in one epoxy ester coating is shown below:

COMPOSITION			
Epi-Rez[1] 530		50 parts	50 parts
Emersol[2] 9315 D.D. Liquid F.A.[3]		50	44.5
Empol[2] 1022 Dimer Acid		0	5.5
% Solids		60	60
Solvent		Xylene	Xylene
Viscosity, Gardner-Holdt		N	X-Y
Acid Value		1.4	3.7
Color, Gardner		4	6
AIR DRY, SAND TRAIL METHOD (0.03 Co, 0.3 Pb as naphthenate dryers)			
(adherence of sand due to lack of through-dry)	3 hrs.	tacky	tack-free
	8 hrs.	sl. tacky	tack-free
SWARD HARDNESS			
	2 days	2	2
	1 week	6	8
	2 weeks	13	16
	4 weeks	22	27
CHEMICAL RESISTANCE PROPERTIES			
Boiling 2% NaOH, 1 hr.		badly broken	sl. broken
Boiling Water			
	1 hr.	sl. loss adhesion	unchanged
	2 hrs.	pimples	pimples
	4 hrs.	darkened, broken	darkened, not broken
2% Tide[4], 160°F, 4 hrs.		lifted badly	lifted badly
5 DAY ULTRA VIOLET EXPOSURE OF PAINTS			
Change in yellowing index (Larger value indicates more yellowing)		8.6	3.9
Impact resistance after exposure (Gardner variable impact, inch-lbs)			
	Concave	>160	>160
	Convex	110	140

[1]T.M. Jones-Dabney Company
[2]T.M. Emery Industries, Inc.
[3]Emery Industries, Inc., Fatty Acid Division; I.V. 145-160
[4]T.M. Procter & Gamble Company

9120 WALLPOL

RCI's PVAc COPOLYMER WITH PROVEN DURABILITY ON EXTERIOR WOOD

This Rahway, N. J., home was coated with a 32% PVC vinyl copolymer emulsion paint to determine the durability of RCI 9120 WALLPOL on previously painted wood. Two coats were applied to the cedar shakes – in April, 1957. No primer was used. The shakes had been painted with linseed oil house paint two years earlier; the surface was in good condition and showed only slight chalking.

The photograph and the close-up attest to the condition of the house – 3 years later. The surface condition of the house is good, with only slight chalking on south and east exposures.

RCI 9120 WALLPOL incorporates all of the latest advances in PVAc emulsion technology. Small particle size, high distensibility and a uniquely balanced emulsifier system contribute to these distinct advantages when used on properly prepared exterior wood:

- *ease of application – spreads easily*
- *quick-dry – in as little as 30 minutes*
- *easy soap-and-water clean-up of tools and equipment*
- *retains its appearance for many years – excellent tint retention and low dirt pickup*
- *blister resistant – film allows moisture vapor permeability*
- *permanent flexibility – important for clapboard surfaces*

Write for complete information today, or ask an RCI technical service man to call.

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Hydrochloric Acid • Formaldehyde • Phthalic Anhydride
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Sulfuric Acid • Methanol

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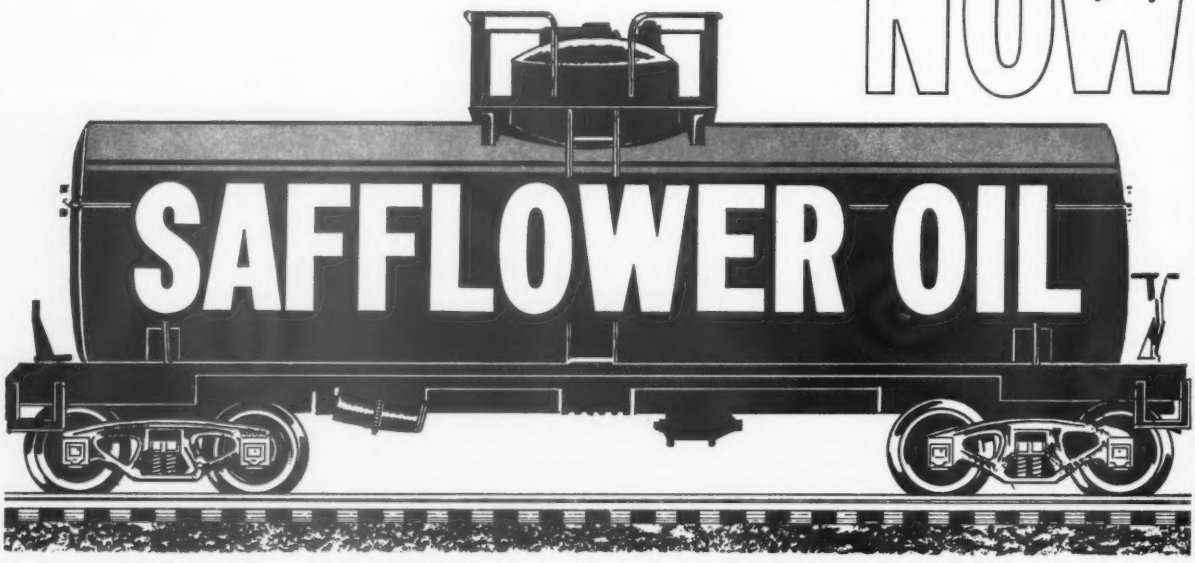
RCI BUILDING, WHITE PLAINS, N. Y.



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You Should Make Vinyl

1 GROWING DEMAND WITH BUILDERS. In 1960, residential siding accounted for over 350,000,000 square feet of strip coated aluminum—a 50% jump from 1959! Building developers know that vinyl coatings sell homes faster—gets their money out sooner.

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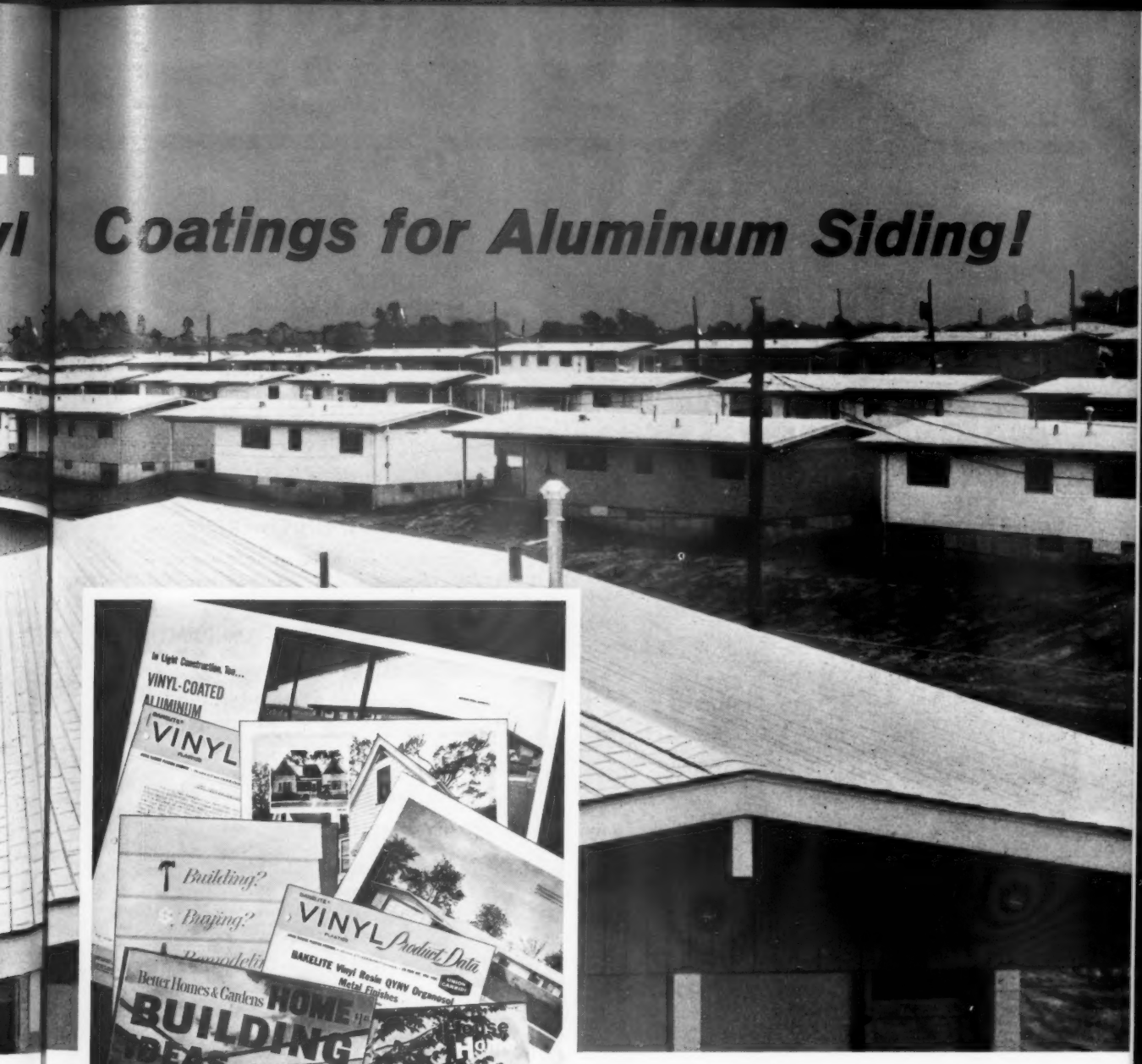

3 EFFECTIVE PROMOTION BEHIND IT. To help you sell more vinyl coatings for aluminum, Union Carbide Plastics Company is telling the vinyl story to homeowners through ads in *Better Homes & Gardens 1961 Home Improvement Idea Book* and *1961 New Homes Idea Book,* to builders through *House & Home,* to building supply dealers through *Building Supply News,* to home improvement dealers through *Building Specialties,* and to coaters and siding manufacturers through *Modern Metals.* For more information, write Dept. HZ-103D, Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. *In Canada:* Union Carbide Canada Limited, Toronto 12.

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- Longest exposure record of any finish for aluminum.
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(SUBSTITUTED OXAZOLINES)

Useful as dispersing agent, pigment grinding aid, and to reduce viscosity of pigment oil mixtures.

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A new phthalo green dispersion, slightly cleaner and bluer than ordinary types.

EXTRA BENEFIT: Maximum economy (5-20% more economical than any other product available)

Unusually low water solubles

Made by unique new process

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This yellow shade green cannot be matched with any weather stable pigment blend.

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Better Paints Start Here

Dow Corning Resin Number and Type	Percent Solids: Solvent Type	Viscosity, Gardner-Holdt	Viscosity, Centipoises	Color, Gardner	Pounds Per Gal.	Flexibility*	Hardness*	Craze Life, Hr. At 250 C	Thermoplasticity*	Leafing*	Service Temp., °F, Colored	Service Temp., °F, Aluminum	Weatherability*	Gloss Retention*	Application
804 Silicone	60 Toluene	A-3 to A	20-40	2	8.8	3	8	100	8	9	400	600	1	10	Blending Resin
805 Silicone	50 Xylene	C-F	80-150	2	8.4	10	3	8000	3	7	550	1000	10	3	Vehicle for Aluminum Paints
806A Silicone	50 Toluene	D-H	100-200	1	8.5	5	8	2500	7	3	500	1000	5	10	Vehicle for High Gloss Enamels
808 Silicone	50 Xylene	F-J	150-250	2	8.4	9	6	5000	4	6	550	1000	10	10	Vehicle for High Gloss Enamels
840 Silicone	60 Toluene	A-1 to A-3	15-25	2	8.8	5	7	900	7	9	450	800	5	9	Blending Resin
R-60031 Silicone-alkyd Copolymer	50 Cellosolve Acetate, Toluene	D-L	100-300	4	8.8	10	10	500	10	10	450	600	10	10	Vehicle for Appliance, Exterior Enamels (Baking Type)
XR-60032† Silicone-alkyd Copolymer	60 Mineral Spirits	V-Y	750-1500	6	7.8	10	9	100	9	3	400	800	10	9	Vehicle for Maintenance Paints (Air Dry)

* Relative Comparison: 1 = very poor; 10 = excellent. † Available in trial samples only.

For more durable coatings formulate with silicone resins

Start your formulation with these Dow Corning resins and copolymers and you're sure to produce finishes that last longer, cut maintenance costs, assure user satisfaction. You can even pre-determine the degree of heat stability, weather resistance, gloss retention, or other properties needed to meet the requirements of specific applications.

In maintenance coatings where heat may be a problem, Dow Corning 805 and 806A Resins provide lasting resistance to 1000 F when blended in aluminum formulations. Such paints are excellent for use on stacks, mufflers, boilers, jet engines, exhaust manifolds and other hot spots. Where painted areas must maintain color at temperatures up to 550 F, your choice should be 808 Resin. You'll find coatings made with 808 Resin resist fading and chalking . . . lengthen the time between repaintings. And if you're interested in air-drying silicone organic copolymers, note that Dow Corning also offers silicone intermediates . . . you can enjoy the economies of cooking your own vehicles.

Product finishes, too, are better when you start with silicones. In this field, Dow Corning R-60031 silicone-alkyd copolymer helps in formulating decorative finishes that hold color and adhere well at surface temperatures as high as 450 F. Finishes made with this copolymer are ideal for space heaters, clothes driers, stoves, other hot appliances. When temperatures rise to 550 F, Dow Corning 804 and 808 Resins are recommended.

You make better finishes when you start with the Dow Corning silicone resins and copolymers listed above. For more specific information, write Dept. 6516.

Your best source for information about silicone resins, intermediates, and paint additives is the Dow Corning office nearest you.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

DICALITE®
TECHNICAL REPORT
DICALITE DEPARTMENT • GREAT LAKES CARBON CORPORATION • 612 SO. FLOWER ST., LOS ANGELES 17, CALIFORNIA

Dicalite Research Throws New Light on Testing for Gloss and Sheen

Unexpected results obtained during a three-month research project in the Dicalite products laboratory at Walteria, California, may provide an answer to test inconsistencies which have puzzled paint technicians.

This research was undertaken to evaluate fillers and inert pigments as flatting agents, with particular reference to particle size range and distribution.

Formulations were first checked by Hegman gauge to measure the fineness of grind of the inert pigments. Paint films were then drawn down on standard 1/16″ steel test plates for checking with the glossmeter and the flatness gauge.

At this point puzzling inconsistencies began to be apparent.

Repeated tests on identical formulations under identical conditions gave variable results. After thoroughly checking all the factors involved, it was discovered that the test plates could not have a sufficiently true surface. Since flatness and gloss are a function of the thickness of the paint film, all other factors being equal, an absolutely true plane surface is essential for accurate and reproducible readings. The problem was solved by the use of special steel plates ¼″ thick, with a machined surface perfectly flat within tolerances less than 0.0005″.

Using these plates, reproducible results were obtained in all succeeding tests. Paint films, 0.003″ and 0.005″ thickness, were drawn down with a Boston-Bradley adjustable blade, and checked for gloss and sheen at 60° and 85° angles. All tests were made without possibility of bias: formulations were blind coded. As a point of interest, all Dicalite materials produced for paint use were found to have Hegman readings in the 3 to 4 range.

It may be stated, on the basis of these tests, that in testing for degree of gloss or sheen, variations from a true plane surface in the test plate (and hence in the thickness of the paint film) will produce wider differences in the readings than will the widest variations in available filler materials and flatting agents.

To the best of our knowledge, no reference to this effect has appeared in trade literature.

The Dicalite products laboratory welcomes comments regarding similar testing procedures.

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W. R. SMITTLE

DICALITE'S "MAN ON THE SPOT"

One of the busiest men in the organization is W. R. Smittle, in charge of quality control and customer service work in the Dicalite products laboratory at Walteria, California.

In Smitty's fifteen years with Great Lakes Carbon Corporation he has run or supervised tests or research on everything from antibiotics to zein, including practically every chemical in commercial use. One of his accomplishments was original work leading to the successful filtration of the bacterial excrements known as pyrogens, which many authorities, until then, had claimed were non-filterable.

Smittle obtained his Master's degree at the University of Illinois, after graduation from Kansas State University, and for the eight years prior to joining Great Lakes Carbon was employed in the technical department of Bowman Dairy Company, in Chicago.

The paint research reported in the accompanying columns was conducted under his direction.

NEW DATA SHEETS

contain a summary of these tests for the information of the paint industry. For your copy, write Dicalite Dept., 612 So. Flower St., Los Angeles 17, Calif.

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There's more money in masonry paint now that Velsicol W-617 resins are here!

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2. **A formulation with a 10% replacement of the original vehicle with Velsicol W-617 resin.**
3. **A formulation with a 25% replacement of the original vehicle with Velsicol W-617 resin.**

The masonry paints were applied to asbestos shingles in two coats. Two panels of each paint were placed on exposure in Florida and Ohio. After two years exposure in both locations the paints on all three panels are in excellent condition! These test panels were exposed to tropical sun, salt air, rain, snow, sub zero temperatures and the analysis of a cost accountant. The facts are apparent; Velsicol W-617 resins save money in masonry paint formulations without compromising quality. WRITE NOW FOR TECHNICAL DATA AND TEST SAMPLES so that you can learn first hand how to make more money on your masonry paint products.

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Your Velsicol representative, a qualified chemist who can help you make better products for less!

FREE W-617 test samples and literature

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☐ Please send test samples of Velsicol W-617 Hydrocarbon Resins.
☐ Please send complete technical data. ☐ Have representative call.

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- High total solids for 1-coat coverage.
- Excellent gloss and can appearance.
- Excellent leveling and flow properties.
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- Solution type, not an emulsion.
- Can be used like conventional housepaints.
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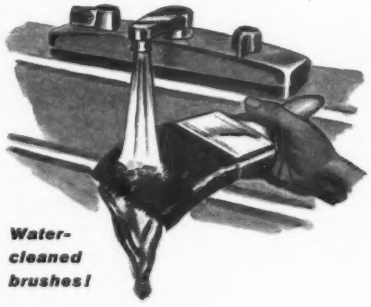
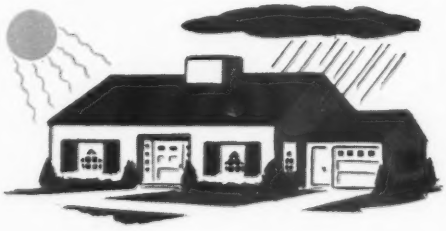
- Good freeze—thaw stability.

With Linaqua® new wood requires only ⅔ as much labor and paint, as latex. Repainting requires only ⅓ as much paint and labor as latex.



Water-cleaned brushes!

Linseed oil performance!



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- Good pigment dispersion.
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- No vehicle handling problem or foaming.
- Non-corrosive.

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Introducing a New Approach to Water, Alcohol, Solvent and Plasticizer Resistance—

Modern Nitrocellulose Furniture Finishes

By
R. E. Boddroff
and
R. F. Wint

INTRIGUING ideas about exciting new coatings have become routine shop-talk wherever protective coatings chemists gather. This paper describes another such coating; specifically a furniture finish. Here are its special values. It enables its user to pack and ship furniture the same day the finish is applied. It has unlimited package stability. It is so versatile that an infinite variety of color effects can be produced. It has the unique property of permitting scratched and marred areas to be spot-repaired. In addition, because this finish rubs and polishes so easily, users can produce furniture with such rich patina, such appealing lustre, that enhancement of the sales appeal of their product results. Such a finish should easily capture the imagination and enthusiasm of a progressive furniture industry—*and it has*, for, of course, this description fits conventional nitrocellulose lacquer as it might have been described if it were being introduced for the first time today.

Consumption

It is a fact that nitrocellulose lacquers are a substantial part of the American market for furniture finishes. In an extensive survey of the American wood finishing industry,[1] the consumption breakdown of finishes was developed as given in Figure 1.

Since the 1946 survey, nitrocellulose lacquer usage had increased from 76% to 80% of the total market. Use of urea-alkyd synthetic finishes expanded from 2 to 17%, whereas oleoresinous varnishes had dropped from 22% to 3%. In gallonage, the consumption of all wood furniture lacquers was placed at the 16,200,000-gallon level. This volume was distributed as shown by Figure 2.

The finish pattern by furniture price groups was also studied as shown in Figure 3.

It appears that more medium- and high-priced furniture is finished with lacquer. Synthetic varnishes, on the other hand, predominate in the low-priced furniture group.

Advantages

Considerations in finish selection were also studied as part of the survey.

Figure 4 illustrates the high value attributed to the appealing appearance of nitrocellulose lacquer by all price groups. Other important reasons for selection of a lacquer finish included fast drying rate, ease of rubbing, durability, and ease of spot-repair.

Among synthetic users, functional properties including good one-coat build, high gloss, and durability were cited as the main reasons for selecting this type of finish.

Lacquer users felt that the superior appearance of lacquer was very important in all price groups. Other important reasons were fast drying rate and ease of rubbing.

Based on these opinions, even though lacquers afford a good balance in application ease and end use requirements, synthetic finishes will continue to dominate in the low price furniture field unless lacquers can be formulated which will have:

1. Better resistance to solvents.
2. Better build, which means high solids at spray viscosity.

The basic problem, therefore, is the formulation of lacquers that combine these properties with the well known good qualities of nitrocellulose lacquers.

Messers Boddroff and Wint are associated with The Hercules Powder Co., Wilmington, Del.

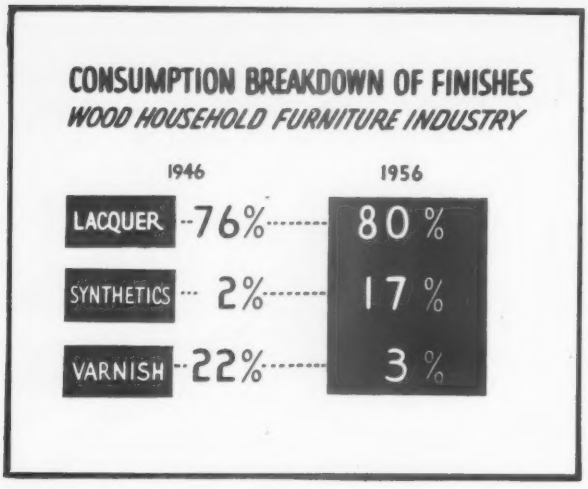


Figure 1

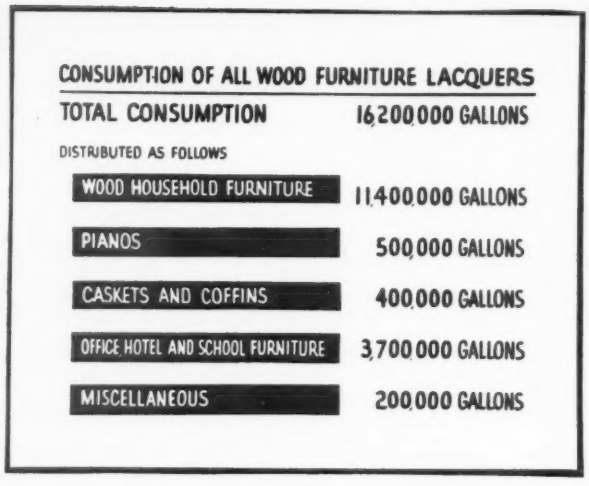


Figure 2

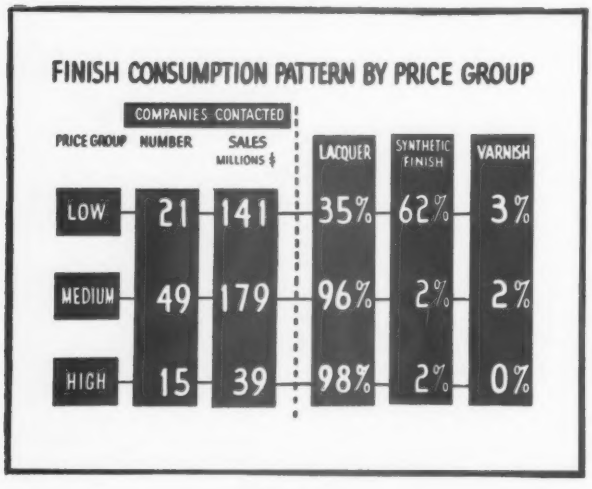


Figure 3

Figure 4

Formulation Trends

During the past 5 years several attempts were made to formulate a lacquer having high solids, gloss, and solvent resistance of the synthetic resins while retaining the good properties of conventional lacquers. In the early work, nitrocellulose-alkyd-melamine lacquers were formulated that had good gloss and good outdoor durability; however, these lacquers fell short of the mark in solvent resistance.

The formulation resulting from the initial study is shown in Table I. This figure also shows a comparison of some of the properties of the catalyzed lacquer with those of a commercial low-bake synthetic finish and a "medium quality" furniture lacquer. Both lacquers were air-dried; the synthetic was cured for one hour at 140°F.

It can be seen from Table I that the catalyzed lacquer showed an improvement over the medium-quality lacquer in alcohol resistance and solids content at spray viscosity. No significant differences in other properties were noted.

Compared with the synthetic finish, this catalyzed lacquer offered the advantages of fast air-dry, slightly better rubbed gloss, and better alcohol resistance. The synthetic finish, however, sprayed at higher solids, had better mar resistance and was more resistant to oxygenated solvents.

Continued development work showed that improved catalyzed amine-resin lacquers could be prepared by proper selection and formulation of both the catalyst and the amine resin. The formulation and performance properties of an improved catalyzed lacquer are shown in Table II. This table also shows a comparison of the properties of the catalyzed lacquer with those of a commercial low-bake synthetic and a control typical of a high-quality furniture lacquer. Both lacquers were air-dried; the synthetic was cured one hour at 140°F.

As a result of the promising improvements in properties just described, additional laboratory work involving several variables was undertaken. First, compositions of higher amino resin content were evaluated with the basic ratio of 10 nitrocellulose, 18 alkyd, 13 amino resin and 2 plasticizer. The non-drying alkyds tested were of the glycerol type (Aroplaz 2570) and PE-glycol type (Cellolyn 502). The amino resins tested were Beetle 216,

TABLE I. CATALYZED AMINE RESIN-MODIFIED LACQUER INITIAL FORMULATION

Solids Composition	Typical Medium Quality Lacquer	Amine Resin-Modified Lacquer	Commercial Low-Bake Synthetic
RS* Nitrocellulose, ¼ Sec.	34	23	
Cellolyn® 502	30	45	
Uformite® F-240	—	22	
Lewisol® 33	20	—	
Dioctyl Phthalate	8	6.5	
Raw Castor Oil	8	—	
Mono-Octyl Acid o-Phosphate	—	3.5	
	100	100.0	
% Solids as Sprayed	18	28	45
Sward Hardness	18	18	20
Initial Gloss	Good	Fair	Fair
Rubbed Gloss	Good	Fair-Good	Fair
Mar Resistance	Poor-Fair	Fair	Good
Alcohol Resistance	Poor-Fair	Good	Fair
Acetone Resistance	Dissolves	Poor	Fair

*Hercules trademark. Cellolyn and Lewisol are registered tradenames of Hercules Powder Co.
Uformite is a registered tradename of Rohm & Haas Co.

TABLE II. CATALYZED AMINE RESIN MODIFIED LACQUER FINAL FORMULATION

	Control Lacquer	Catalyzed Lacquer	Commercial Low-Bake Alkyd
Solids, Wt. %			
RS Nitrocellulose, ½ sec.	40	22	—
Cellolyn 502	50	—	—
Aroplaz 2570	—	39	—
Beetle 216	—	31	—
Dioctyl Phthalate	10	5	—
Butyl Phosphoric Acid	—	3	—
	100	100	
Volatile, Wt. %			
Toluene	50	30	—
Butyl Acetate	20	15	—
MIBK	—	25	—
MEK	10	20	—
Ethyl Alcohol	10	5	—
Butyl Alcohol	10	5	—
	100	100	
Sprayable Solids, Wt. %	20	28	40
Viscosity (No. 4 Ford Cup), Sec.	22	24	22

PERFORMANCE OF CATALYZED LACQUER

	Control Lacquer	Catalyzed Lacquer	Commercial Low-Bake Alkyd
Dry Time, 75-80°F.			
Dust Free, Min.	3-5	3-5	(1 hr. cure
Print Free, Min.	20	45	at 140°F.)
4 hr. Sward Hardness, %	40	26	
24 hr. Sward Hardness, %	42	46	34
Cold Check Cycles (120°/–6°F.)	13+	13+	13+
Ease of Rubbing and Polishing	Good	Good	Fair
Solvent Resistance			
Nail Polish Remover (1 hr.)	Dissolves	No Effect	No Effect
100 Proof Ethanol (1 hr.)	Dull	No Effect	No Effect
Boiling Water (5 min.)	No Effect	No Effect	Permanent Blush
Vinyl Plasticizer Migration (Naugahyde, ¼ p.s.i., 7 days, 120°F.)	Mars	No Effect	No Effect

Resimine U-920 and Uformite F-240.

A series of catalysts were evaluated.

A. Butyl phosphoric acid (Monsanto).
B. Monooctyl acid orthophosphate (Victor).
C. Ethyl acid phosphate (Virginia-Carolina).
D. Butyl acid phosphate (Virginia-Carolina).
E. Isooctyl acid phosphate (Virginia-Carolina).
F. Amyl acid phosphate (Monsanto).
G. P-toluenesulfonic acid (Eastman).

Evaluation

The lacquers were evaluated with respect to sprayable solids, viscosity stability, cold check, solvent and water resistance, Sward Hardness and dry time. All performance tests were run on unfilled, unsealed ¼ inch maple-faced plywood.

The formulation and performance properties of the final catalyzed lacquer is shown in Table III. This figure also shows a comparison of the properties of the catalyzed lacquer with those of a commercial low-bake synthetic and a control typical of a high-quality furniture lacquer. Both lacquers were air-dried; the synthetic was cured one hour at 140°F.

It can be seen from these data that another very important characteristic can be added to the already imposing list of properties that have helped conventional nitrocellulose lacquers maintain their dominant position in the wood-finishing market. The solvent resistance of the catalyzed lacquer, as measured by exposure to butyl acetate, is one of the most striking advantages contributed by amine resin modification. The solvent resistance was determined on 2 mil films on unfilled, unsealed maple panels. All films were air dried 2 weeks before testing. The butyl acetate and ethyl acetate tests were run by placing saturated 1 inch squares of flannel on the panel and covering with a watchglass. The spot was examined after one hour. The hot water test was run by placing the panel, coated side down, over the top of a 500 cc. filtration flask in which water was kept boiling. Panels were removed after

TABLE III. CATALYZED AMINE-RESIN LACQUERS IMPROVED FORMULATION

Ingredients	Control Lacquer	Catalyzed Lacquer A	Catalyzed Lacquer B	Commercial Low-Bake Synthetic
RS* Nitrocellulose, ¼-sec.	40	23	—	—
RS Nitrocellulose, ½-sec.	—	—	23	—
Dioctyl phthalate	10	5	5	—
Cellolyn® 502	50	—	—	—
Aroplaz 2570	—	42	42	—
Beetle 216	—	30	30	—
n-Butyl acid phosphate	—	3	3	—
Total	100	103	103	
Performance				
Sprayable solids, %	21(1)	31(2)	28(2)	40
Viscosity (No. 4 Ford cup), sec.	22	24	24	26
Sward hardness, %				
1 hour	38	16	22	—
4 hours	40	20	26	—
24 hours	42	40	46	34
Cold-check (120°/–6°F.)	13+	7	13+	13+
Solvent Resistance (3)				
Butyl acetate (1 hr.)	dissolves	no effect	no effect	no effect
Ethanol, 95% (1 hr.)	dull	no effect	no effect	no effect
Water, 90-100°C. (5 min.)	no effect	no effect	no effect	bad permanent blush
Ease of rubbing	good	good	good	fair
Viscosity increase, 8 weeks	none	10%	10%	10%

NOTES:

(1) **Solvent:**

Toluene	50
Butyl acetate	20
Ethyl acetate	10
Ethyl alcohol	10
Butyl alcohol	10
	100

(2) **Solvent:**

Toluene	30
Methyl isobutyl ketone	25
Methyl ethyl ketone	20
Butyl acetate	15
Butyl alcohol	5
Ethyl alcohol	5
	100

(3) Spot test under watch glass.

*Hercules Trademark

1 minute and inspected. This means that it is now possible to formulate air-dry lacquers which will resist nail polish remover, alcoholic beverages, and other conventional solvents.

The nail polish resistance of a catalyzed lacquer is illustrated in Figure 5 where comparative performance with (1) conventional nitrocellulose lacquer, (2) cellulose acetate butyrate lacquer, and (3) commercial urea-alkyd-amine synthetic is shown. Nail polish dissolved both the conventional nitrocellulose lacquer and the cellulose acetate butyrate lacquer. It did not affect either the catalyzed lacquer or the synthetic finish.

Figure 6 shows a similar test pattern comparing alcohol resistance. The appearance of the test areas shows that ethyl alcohol softened the cellulose acetate butyrate lacquer considerably and the conventional nitrocellulose lacquer sufficiently to permit noticeable marking. It did not dull, soften, or mark either the catalyzed lacquer or the synthetic.

The results of hot water exposure were different as shown in Figure 7. Both catalyzed lacquer and conventional lacquer passed this test without being affected. However, the urea-alkyd synthetic was marked badly by the hot water and the cellulose acetate butyrate lacquer was moderately affected.

Another characteristic of catalyzed lacquers worthy of mention is their ability to resist the migratory plasticizer from vinyl upholstery fabrics. The comparative performance is shown in Figure 8 which pictures the condition of the lacquer film after a 1″ x 1″ piece of vinyl fabric had been placed in direct contact, covered with a 100-gram weight and maintained at 160°F. for one hour. The pronounced marking of both conventional lacquer and cellulose acetate butyrate lacquer is easily noticeable. The absence of any mark on the catalyzed lacquer indicates its resistance to the plasticizer of the vinyl fabric.

The new catalyzed lacquers are fast, air-dry finishes, and do not require a bake like a conventional synthetic. By having 20-25% nitrocellulose in the film, the fast air-dry and rubbing qualities—which are characteristic of conventional nitrocellulose lacquers—are retained. Unlike the urea-alkyd synthetic finishes, special lubricants and special polishing compounds are not required. The sprayable solids attainable with a catalyzed lacquer are 28-31% at room temperature, or about midway between the solids of a synthetic and a standard-type lacquer. The catalyzed lacquers can be spot-repaired, several hours after application following the same technique used with conventional lacquers. However, after the catalyzed lacquer film has been converted to insolubility, repair techniques used for ordinary synthetics are necessary.

Most of this work was done with maple panels finished without filler or sealer. No lifting of the catalyzed coating was encountered. However, when complete systems were prepared the following facts were uncovered:

1. Lifting cannot occur unless 2 coats of catalyzed lacquer are applied over fillers and conventional sealers.
2. On sealed or filled wood lifting can be avoided by applying all coats of catalyzed lacquers within 3 to 6 hours. If the first coat of catalyzed lacquer is allowed to dry longer, lifting may occur when a second coat is applied.
3. On sealed or filled wood, lifting can be avoided by omitting the catalyst from the first coat or amino resin modified lacquer. Catalyst in the second coat is sufficient to convert both topcoats.

TABLE IV. COMPARATIVE PROPERTIES OF COATING MATERIALS WITH PLASTICS

*Marks indicate desirable properties of the finish based on these tests alone Total*marks indicate relative desirability For further advantages of Polyesters and Epoxies see Reference No. 2

Test	Wate White NC Lacquer Finish	Amine Lacquer Finish	Epoxidized Lacquer Finish	Alkyd Urea Synthetic Finish	Epoxy Finish	Polyester Finish	Laminated Plastic
Cold Check Ten Cycles	* OK	* OK	* OK	* OK	* OK	* OK	* OK
Mar Resistance	deep mar	hght mar	hght mar	hght mar	no mar	no mar	no mar
Rate of wear Taber A brason Grams/100 cycles	.107	.104	* .105	.108	* .067	.117	* .052
Color Retention 42 hrs. intense Florida sunlight under glass	* very slight darkening	* very slight darkening	* very slight darkening	* very slight darkening	slight darkening	* very slight darkening	* very slight darkening
Alcohol 100 proof (trapped o'nite)	softens, whitens, recovers	softens, recovers hardness	softens, recovers hardness	softens, recovers hardness	* no effect	* no effect	* no effect
Water (trapped o'nite)	* no effect	* no effect	* no effect	slight softening, recovers	* no effect	* no effect	* no effect
Tri Sodium Phosphate cleaning solution (trapped o'nite)	Slight softening, recovers	Slight softening, recovers	Slight softening, recovers	Slight softening, recovers	* no effect	* no effect	* no effect
Hydrochloric Acid 37% 2 cc 1 hour	* no effect	* no effect	moderate discoloration	moderate discoloration	* no effect	* no effect	loss of gloss, slight softening, recovers hardness
Sodium Hydroxide 10% (trapped o'nite)	very slight softening recovers	* no effect	* no effect	* no effect	* no effect	loss of gloss softens, recovers somewhat	* no effect
Acetone (trapped (1 hour)	softens badly	softens recovers	softens recovers	* no effect	* no effect	* no effect	* no effect
TOTAL see explanation)	4*	5*	4*	4*	9*	8*	9*

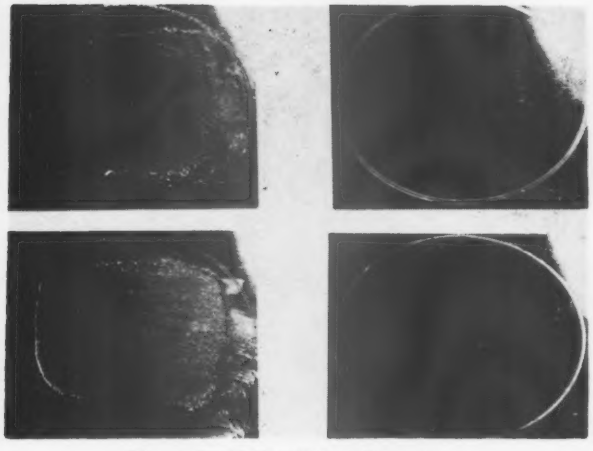


Figure 5. Nail polish resistance.

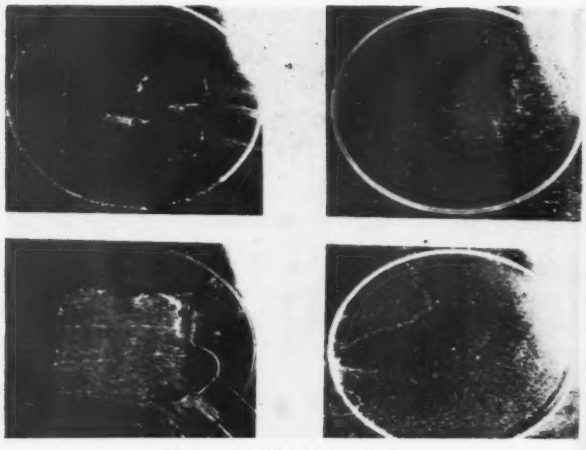


Figure 6. Alcohol resistance.

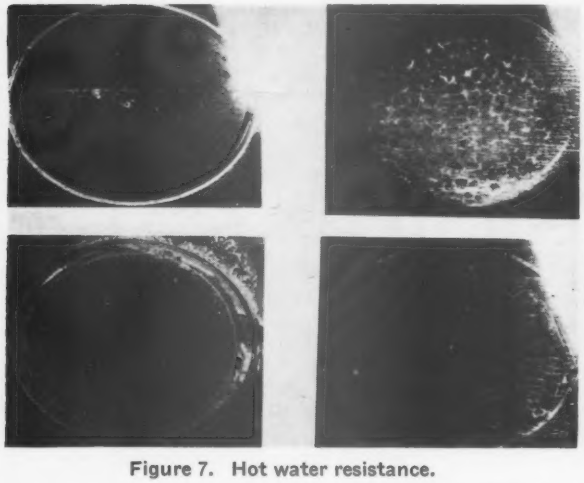


Figure 7. Hot water resistance.

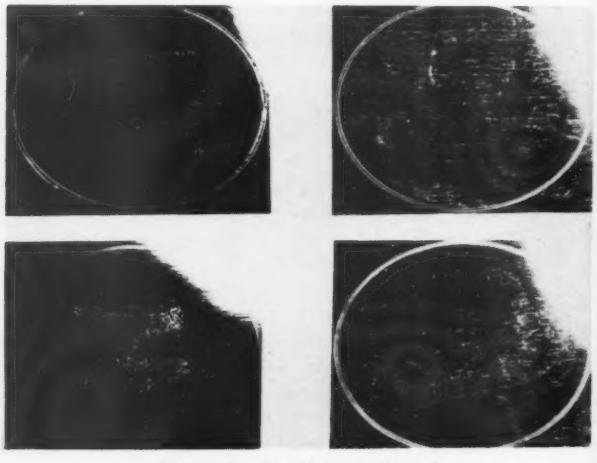


Figure 8. Plasticizer migration.

Finish Types Evaluated in Each Case:

Upper Left—Conventional Lacquer

Upper Right—Synthetic Finish

Lower Left—Butyrate Lacquer

Lower Right—Catalyzed Lacquer

Perhaps a few comments should be made regarding the stability of catalyzed lacquers. Stability of catalyzed lacquers, without catalyst, is exceedingly good—equal to ordinary lacquers. With catalyst added, the viscosity increase is negligible for at least 2 months. After 7 to 8 months the viscosity had doubled. This would indicate that the catalyzed lacquer should be considered a 2 package system.

On the basis of the data obtained to date, catalyzed amine resin-modified lacquers make it possible to combine the outstanding good qualities of conventional lacquers with the best features of synthetic resin finishes. The trade shows indications of recognizing this fact and appears willing to grant these improved furniture finishes their niche among acceptable commercial finishes for wood. One example of such acceptance is the evaluation of "Comparative Properties of Materials With Plastics" by F. H. Thomas[2] reproduced in Table IV.

This tabulation is significant for several reasons. First, it lists catalyzed amine lacquers as a separate and distinct type of wood finish; second, it shows the favorable performance of this type of lacquer compared to three competitive commercial finishes; and finally, it shows a comparison of the performance of amine lacquer with laminated plastic and with experimental epoxy and polyester conversion finishes.

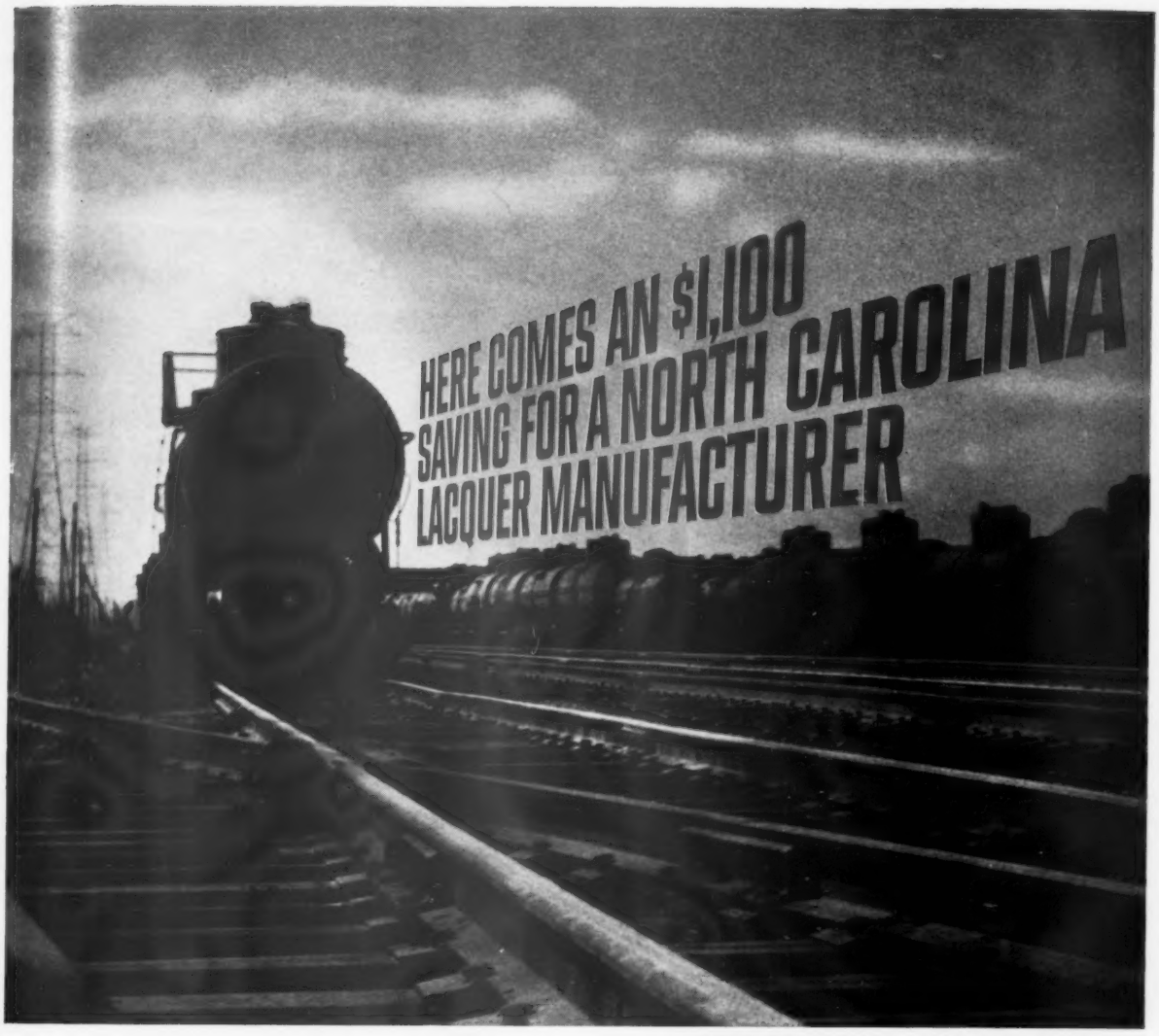
The performance of the catalyzed amine lacquer *after application*, while not equal to that of laminated plastic in chemical resistance and mar resistance, is extremely favorable when other factors are considered. These include good spraying characteristics; ease of spot-repair and stability in storage; advantages in the factory where the finish must be applied, and in depth, sheen, clarity and patina; advantages on the showroom floor of the retail furniture stores where the finish must stand the crucial test of consumer acceptance.

References

(1) Hercules Powder Company, "The Wood Furniture Industry and Its Finishing Practices", a summary of the findings of a market survey during 1957, Form No. 500-293, 16 p, 1958.

(2) F. H. Thomas, "A Comparison of Furniture Finishes"Furniture Design and Manufacturing, Vol. 31, No. 12, p. 324, December, 1959.

This paper was presented by R. F. Wint before Protective Coatings Division, Chemical Institute of Canada, February 1960 and by R. E. Boddorff before Protective Coatings Symposium, North Dakota Agricultural College, June, 1960.



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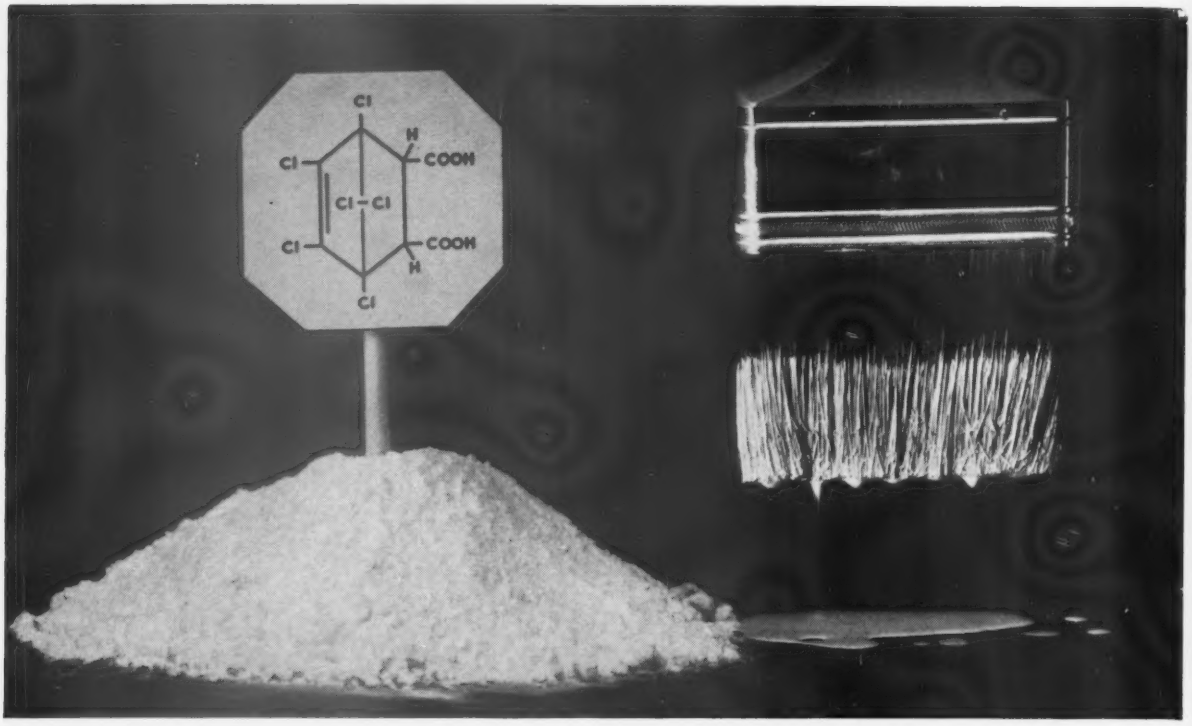

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Fatty Acids *vs.* *Whole Oils* in ALKYD RESINS

By
Kenneth A. Earhart
Consultant

THERE are many facets to the differences between the usage of fatty acids and whole oils in alkyd resins. Rather than being a highly controversial subject, a summation of the pros and cons of each of these materials, in the light of the end uses to which a particular alkyd is to be subjected, generally indicates which material will be used.

This paper is not restricted to a comparison of whole oils and fatty acids with glycerol as the common denominator, since to do so would limit the scope and therefore not reflect the wide usage of both fatty acids and oils in alkyd resins.

This subject can be approached from many angles, but the approach employed here is a discussion of the advantages and disadvantages of fatty acids and whole oils in alkyds from the practical viewpoints of economy, handling and formulation ease as well as the technical viewpoints covering the chemical and physical properties contributed by, or derived from, certain individual fatty acids. While this dual approach may result in duplication of discussion in some areas, it will serve to emphasize the more important areas of consideration.

Paper presented at the 1961 Annual Convention of the Association of American Soap and Glycerine Producers, Incorporated, on January 25th, 1961, New York City.

Advantages of Fatty Acids

From an alkyd formulators viewpoint, flexibility of formulation is probably the greatest advantage of all. This means that alkyds can be compounded from all types of fatty acids available on the market without regard to the restriction of using some glycerol which goes concurrently with the use of oils. Put in other words, the alkyd formulator can use glycerol, pentaerythritol, di-pentaerythritol, tri-pentaerythritol, trimethylolethane, trimethylolpropane, sorbitol and a host of glycols such as ethylene glycol, propylene glycol and neopentylglycol, as well as some of the more exotic polyhydric alcohols such as inositol, anhydroenneaheptitol and dimethyl glucoside. Flexibility in formulating is quite important when the chips are down and the alkyd chemist is asked to come up with something out of the ordinary.

Not to be overlooked is the fact that monobasic acids such as rosin, benzoic acid, tertiary butyl benzoic acid, toluic acid, 2-ethyl hexoic acid, tall oil acids and others not derived from whole oils can, and should be, included in the category of flexibility of formulation.

When the alkyd chemist is not restricted by the glycerol and fatty acids which come with the whole oil, his attention can be focused on making a specific alkyd from the great variety of monobasic acids available, together with almost an equal variety of polyols. Included in his choices, of course, are an endless variety of mixtures of monobasic acids as well as polyols which can be compounded to get the results he is striving to obtain.

While the permutations and combinations are practically limitless, blends of various grades of tall oil acids with linseed and soybean fatty acids give very economical mixtures, while blends of low-rosin tall oil acids with segregated cottonseed fatty acids give much higher quality performance than can be obtained from oils regardless of price. Thus, the alkyd chemist is more and more appreciating the composition of the types of fatty acid mixtures he has available.

Included in the advantages of fatty acids should be the availability of types. Ten years ago, we were more or less restricted to the simple distilled fatty acids which were available from acidulated soapstocks. Today, we have several grades of segregated fatty acids which are manufactured by taking advantage of the insolubility in solvents of the saturated acids, palmitic and stearic, which occur in soybean and cottonseed oil. During this period we have also seen the mushrooming of high-quality low-rosin tall oil fatty acids and improvements in this area are continuing. Synthetically, pelargonic, tertiary butyl benzoic and 2-ethyl hexoic acids have become commercial. Many acids are still on the research laboratory's shelves while others are presently undergoing the rigors of evaluation.

In the next ten years we will probably see the introduction of more new monobasic acids from petrochemical sources. Not to be overlooked is the accumulating know-how in the area of aromati-

zing, isomerizing and chemically modifying the naturally occurring fatty acids. Advances of this type will be none too soon in helping to stem the tide of other synthetic products used in the coatings industry in competition with alkyds such as the polybutadiene-styrene, polyvinyl acetate and polyacrylate resins.

Another area of advantage for fatty acids is that they impart better performance properties to alkyds than whole oils when compared on a strictly comparable basis, i.e. with glycerol as the polyhydric alcohol. The reason involved is the inability of an oil to alcoholize to a pure monoglyceride using the techniques commonly followed in the alkyd industry. While there are many papers on the subject of preparing monoglycerides, the one by Feuge and Bailey in 1946 (1) is one of the best since it gives data in the temperature range practiced by alkyd chemists. The more important data from Run #20 in Table I of that paper is presented here:

Temperature, °C	230
Time, hrs.	5
Glycerol, % on fat basis	24.47
Composition of Fatty Portion, % by Wt.	
Monoglycerides	49.1
Diglycerides	43.5
Triglycerides	7.4
Composition of whole reaction mixture, mole %	
Free glycerol	34.3
Monoglycerides	41.9
Diglycerides	21.2
Triglycerides	2.6

From this data it is plainly evident that whole oil alkyds are at a disadvantage, at the moment of phthalic anhydride introduction to the alcoholysis reaction product, in view of the high diglyceride content.

Fatty acids have the advantage that phthalic anhydride esterifies preferentially at a lower temperature than fatty acids, thus limiting di- and triglyceride formation. It is also possible to build up quite large linear glycerol-phthalate molecules before the addition of fatty acids; in fact, the early alkyd chemists reacted as high as 78% of the phthalic anhydride's acid groups with glycerol to get a hard, glossy pill before introducing the fatty acids (2) The modern name for a variation of this procedure as applied to pentery-thritol; fatty acid alkyds by Kraft et al (3), is the "High Polymer Technique". In the pentaerythritol technique, some of the fatty acids are withheld from the initial PE:PA:FA reaction mass until a fairly high polymer is built up, then added. In either case, the objective is the same, i.e. to build up fairly high polymers and to minimize chain stopping by the fatty acids which could lead to low molecular weight polymers e.g. two diglyceride molecules bridged by one phthalic anhydride molecule, or two tripentaerythritides bridged by a single phthalic anhydride molecule.

Of course there is the consideration that a certain amount of ester-interchange defeats the well-laid plans of the "High Polymer Technique" but those who have taken the time to evaluate resins made by these methods will appreciate the better properties of the fatty acid resins versus the whole oil resins. Even if the glycerol type of "High Polymer Technique" is not used, alkyds cooked with all ingredients at once using fatty acids dry faster initially than whole oil type alkyds.

What are the better performance properties of the fatty acid alkyds? The easiest to detect are the faster speed of dry and slightly harder films. The gloss of enamels prepared from fatty acid alkyds are generally higher than those prepared from whole oil alkyds. This is most probably due to the pigment-wetting action of the free fatty acids in the fatty acid alkyds, since an alcoholysis type alkyd should contain no free fatty acid except that due to hydrolysis by esterification water and acidolysis by phthalic acid half esters, but these reactions are considered extremely minor.

Better exterior durability is also a property of fatty acid alkyds and it is felt that this property is due to a combination of better pigment wetting, higher initial gloss and more uniform molecular weight distribution.

Many years ago the writer ran a durability experiment on an alkyd, containing 55% linseed oil, blended with alkali refined linseed oil to make 60, 65 & 70% oil length alkyds. These alkyd; oil blends were compared in a green trim and trellis type enamel with a series of alkyds made by cooking all the ingredients together at once. The latter alkyds fared much better on exterior exposure and, while this is not a direct example of fatty acids versus whole oils, it serves the purpose of emphasizing that even-molecular-weight distribution gives better durability than higher molecular weight alkyds plus free oil.

Disadvantages of Fatty Acids

The disadvantages of fatty acids fall outside the realm of properties contributed to alkyds—they are mostly in the area of economics and other practical considerations.

Safflower fatty acids makes a good example of the difference in the economics of a whole oil and the fatty acids made therefrom. No up-to-date figures were available but several years ago the differential between the oil and the fatty acids was around 10 cents per lb.

While the acidulated soapstocks from cottonseed oil and soybean oil are generally priced low enough to allow fairly priced acids, as compared to the oils, commodity markets have a habit of getting out of balance once in awhile, like that which happened to cottonseed soapstocks some years ago. I assume that the advent of distilled tall oil fatty acids has had something to do with the stability of this market in recent years. However, we still have coconut, safflower, and eleostearic acids from whole oil which are high priced.

One big economic disadvantage of fatty acids is that they must be handled in corrosion resistant containers—drums, tank cars, tank wagons, pumps, pipes and storage tanks. It is impossible to circumvent the extra costs entailed by corrosion resistant containers. In addition, some of the fatty acids—particularly cottonseed, coconut, and soybean—have titers above room temperatures and need to be heated e.g. drums in a "hot box" while tanks must be provided, preferably, with circulating hot water coils. In the colder climates, the storage tanks should also be insulated.

Experience has also shown that fatty acids tend to darken with age more so than oils and should be blanketed with inert gas while in storage. While fatty acid heat stability has been improved by the

(*Turn to page 93*)

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A Study of Heterophase Conditions in

POLYMERIZATION of FATTY ACID ESTERS and STYRENE

By
Dr. Max Kronstein and Hugh A. Taylor
College of Engineering, New York University

In a preceding paper delivered at the 1958 Fall Meeting of the American Chemical Society the formation of three-dimensional, insoluble, polymer solids in the polymerization of polyhydroxyl alcohol-fatty acid esters (fixed oils) and their stable dispersions in monomer fluid oils by means of heating these three-dimensional matters with metalsoap products were discussed. (1) This paper further showed that in the fluid and film-forming dispersions of the gelled and of the incoherent solid phases, the diffraction X-ray spectrum of the undispersed, insoluble gel has been retained and that these dispersions produce in monostyrene the same formation of an insoluble polystyrene as the undispersed polymer solids. These dispersions and their, diluted forms, using volatile solvents, have a very high degree of stability; and some of these dispersions showed after ten years storage in closed container no visible increase in viscosity and had not lost their characteristics after this extended period of storage. Also the finding had been shown that it is possible to determine the Angstrom spacing in such a dispersed gel by the use of the x-ray diffractometer and that an Angstrom spacing of about 4.67 Angstroms had been found. After storing this dispersion for the reported 10-year period, the spacing was still of the same order. There can be no doubt that, in these dispersions, the various phases of the fixed oils are present, since here the solid and the three dimensional phase has been dispersed in the fluid monomer phase.

This study deals with the development of different phases during the polymerization of fluid fixed oils into the ultimately solid three-dimensional oil. It involves:

1. The gradual modification of the initial fluid phase by different forms of energy, such as the energy released from the use of organo-peroxides, and the energy due to exposure to Gamma irradiation. This chemical modification can be understood as a progressing conjugation of existing double-bonds and as the formation of new unsaturated positions.

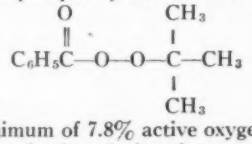
2. The formation of a three-dimensional, insoluble, incoherent, solid phase.

3. The formation of heterophase conditions in the test specimens, which, vary with progressing formation of new phases.

Progressing Chemical Modification

The monomeric oil can be diluted with a great number of solvents into solutions or molecular dispersions. Even at the low concentrations which are required for ultraviolet spectro-analysis, around 0.05%, there is no cloudiness and no precipitation. On the other hand the ultimate three-dimensional solid polymer oil is not soluble in the same solvents, and swells to a limited extent only. It would be expected, therefore, that any further polymeric development of the oil would produce a decrease in solubility. The experiments have shown that even at an early stage in polymerization, when the fluid state of the oil still appears visually to be unchanged and the viscosity increases only slightly, the solutions produce an increasing degree of cloudiness when the same low concentration solutions are being used.

Test tube #1 (Figure 1) contains a 5% solution of a non-polymerized soybeanoil-modified alkyd resin in cyclohexane; in test tubes #2, #3 and #4 are 5% solutions of the same alkyd resin, after the resin has been heated with increasing amounts of an organo-peroxide using 8.2%, 15% and 20% peroxide calculated against the amount of soybeanoil used in the resin solution. As the organo-peroxide t-butyl perbenzoate was used, which is a liquid peroxyester of the formula



containing a minimum of 7.8% active oxygen. That the increasing cloudiness in the solutions is caused by the appearance of an increasing amount of insoluble matter is shown in figure 2, where the insoluble matter precipitated upon standing. The increase in the amount of three dimensional matter produces a considerable increase in viscosity also, after the phase has proceeded to represent some essential amount in the oil or resin.

Ultraviolet Spectra

It cannot be assumed that the various stages of a polymerizing oil consist only of varying amounts of one fluid phase and one solid phase. The fluid phase, too,

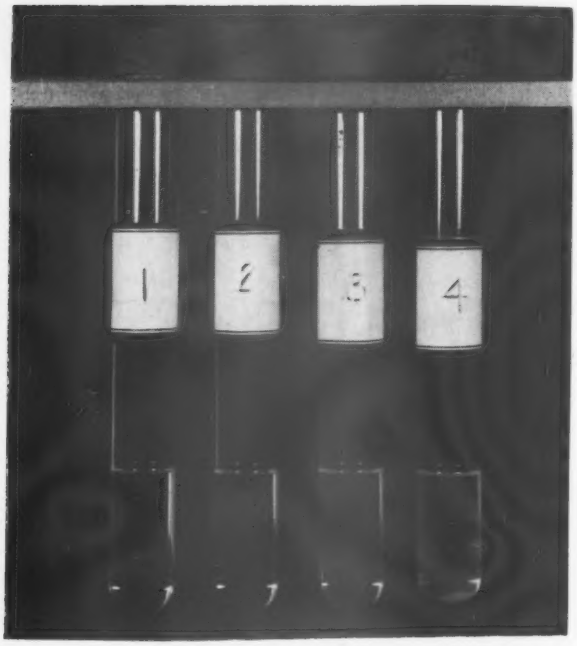


Figure 1. Five percent of soybean oil-modified alkyd in cyclohexane. Tube #1—the alkyd resin, tubes #2, #3, and #4 after heating with 8.2%, 15% and 20% t-butyl perbenzoate respectively.

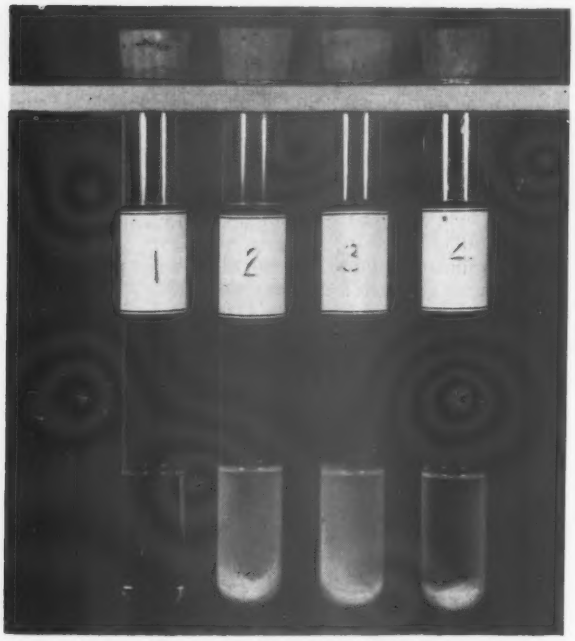


Figure 2. Development of insoluble phase of soybean oil modified alkyd resin.

changes during the polymerization. From the ultraviolet spectra, it appears that with progressing peroxide treatment and further solidification, there is a progressing degree of conjugation occuring in the fluid phase. Figure 3 shows that there are progressive shiftings in a 0.05% solution of soybean-oil, which occur under further treatment with an organo peroxide, di-tibutyl-peroxide, containing a minimum of

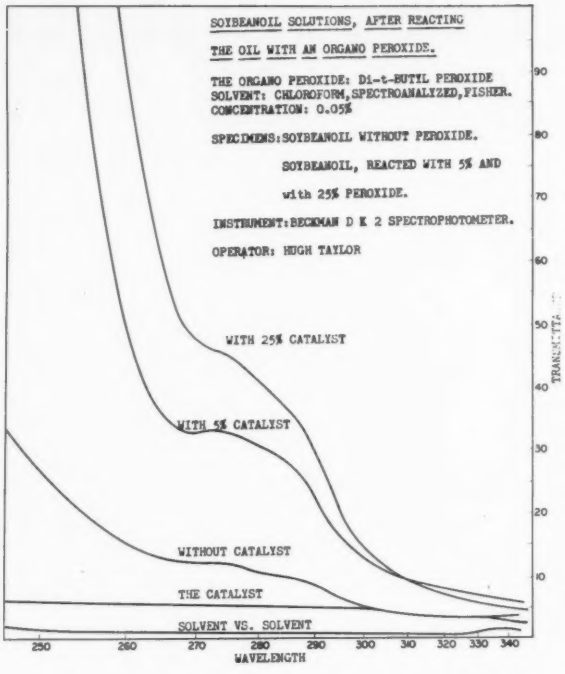


Figure 3. Spectra of soybean oil after reacting with organo peroxide.

Figure 6. Development of insoluble phase of irradiated tungoil. 1—insoluble gel; 2—non-irradiated oil.

10.6% active oxygen. The spectra were prepared using 0.05% solutions in chloroform. These spectra were taken with the DK-2 model Beckman spectrograph, using 10 mm silica cells.

The shiftings are not limited to the effect of a peroxide treatment. Exposure of the oil to other forms of energy shows similar shiftings. A comparison of the oils which show the different spectra were exposed at 77 deg. F. one for a total of 30 Mega Rep, that is 30,000,000 "Roentgen Equivalent Physical Units", the other for 57 M.R. (2) Similar shifting occur in 0.0005% solutions of tungoil, after the same amount of exposure to Gamma radiation. The exposed tung oil changes into of solid polymer which can be filtered off. For instance 3.7585 g irradiated tungoil (57 M.R.) was dissolved in cyclohexane. After the solids settled out, 0.8368 g solid matter was obtained from drying the sedimentation. But here, the "soluble" oil portion was not identical with the unexposed tung oil. The two oils were allowed to stand in an open container for one week. The non-irradiated tung oil remained fluid, with a slight skin formation. The irradiated oil gelled. Figure 4 shows these two oils. The experiments

with different energy sources indicate that the fluid phase also contains oils of different liquid phases in the course of a progressing polymerization. It was of interest, therefore, to investigate how these changes in the heterophase conditions of an oil under treatment will affect the film forming properties of such oils.

Effect on Film Formation

The fact that fixed oils with more than one double bond in each of their fatty acid groups can "dry" as continuous film has been known for a long time. Also, it has been known that the initial or "monomer" linseed oil forms such films slower and forms less continuous films that the so-called heat bodied linseed oil, where the oil has reached a lower iodine number and has increased in viscosity.

It was interesting to study how far the film strength can be influenced by progressive polymerization of the oils or by the progressive formation of new chemical phases of the oil, but it was also necessary to develop test methods for such an investigation. One such method is as follows identically shaped fine wire loops were prepared from No. 30 HF coated magnet wire. The twist of both ends of the loops of 18 wires were set into the test oil layer on an aluminum test plate and held there during the curing. The test set-up is shown in Figure 5. At certain time intervals the loop of wire was attached to the spring of a Jolly spiral-spring-type, specific gravity balance, using the heavy instrument spring, which allowed a maximum weight limit. The spring was gradually extended until the wire end was pulled off the film. To provide a uniform rate of pull the motor and test set-up of the Fisher-Payne Dip Coater (ASTM D-23) was used, which provides a nearly constant rate of elongation per unit time. (Figure 6). The elongation (during the removal of the wire end from the film) was determined as the difference in the instrument reading on the spring before the test and at the removal of the wire twist. This difference can be expressed as a value in grams also by the use of the same table. It was to be expected that with progressing cure, the average elongation values would increase; that is, with increasing curing the specimens can be stretched with more weight before releasing the wire. Ultimately, the fully cured coatings might require even more weight for pulling the wire loops out of the test layer than the device might provide.

To produce comparative steps in polymerization, the selected fluids were reacted with varying amounts of an organo-peroxide, such as di-ti butyl peroxide or t-butyl perlpenzoate. The test method has indicated that films which were produced from untreated oils show a very slow development of measurable film strength. Even a chemical modification, such as introducing an epoxy group into a soybeanoil, did not increase the film strength, but under reaction with a peroxide the films showed greater strength. Table 1 shows the manner in which the test results have been taken and calculated. It shows for one such test group the sample treatment, the length of cure, the elongation of the spring before the wire twist is removed, calculated from Figure 6, the number of grams which correspond to such spring elongation.

To increase the film strength and the rate of increasing oils with certain modifications were used. Figure 7 gives data for soybean oil as a 50% modification of an alkyd resin. As in untreated oils themselves, the film strength increased with the peroxide reaction of the oil matter. The figure shows the test results with varying amounts of peroxide. But even for one given set of peroxide test results show similarly varying effects with increasing curing temperatures. This is shown in Figure 8. There is a limit to the tests with increasing amounts of peroxide. After a certain amount of peroxide has been reacted and a certain temperature has been reached, the peroxide becomes active at a rapid rate, resulting in the formation of incoherent solids, which

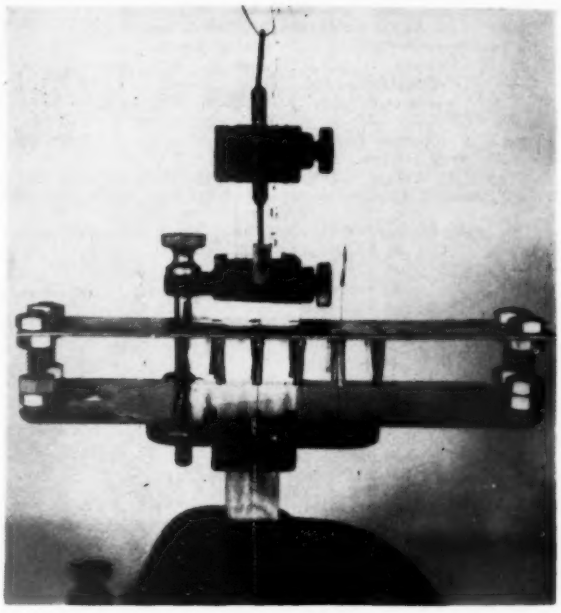


Figure 5. Test-setup for evaluating specimens.

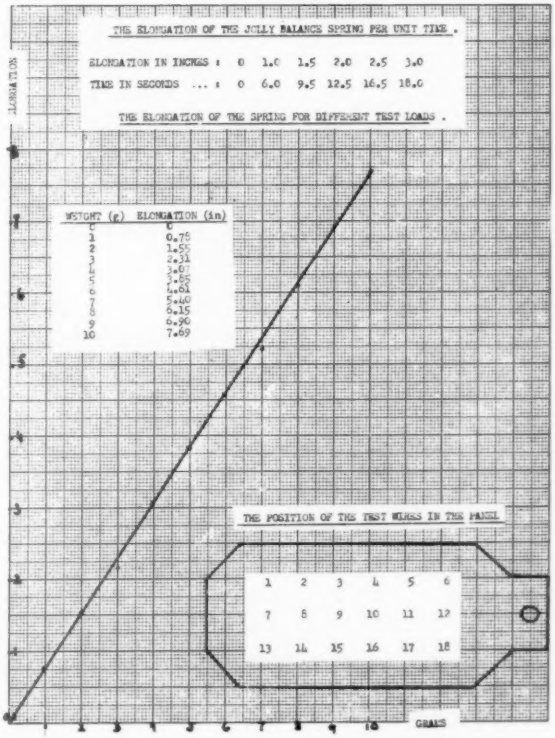

THE ELONGATION OF THE JOLLY BALANCE SPRING PER UNIT TIME .
ELONGATION IN INCHES : 0 1.0 1.5 2.0 2.5 3.0
TIME IN SECONDS ... : 0 6.0 9.5 12.5 16.5 18.0
THE ELONGATION OF THE SPRING FOR DIFFERENT TEST LOADS .
ELONGATION
WEIGHT (g) ELONGATION (in)
1 0.75
2 1.55
3 2.32
4 3.07
5 3.85
6 4.61
7 5.40
8 6.15
9 6.90
10 7.69
THE POSITION OF THE TEST WIRES IN THE PANEL
1 2 3 4 5 6
7 8 9 10 11 12
13 14 15 16 17 18
GRAMS

Figure 6. Elongation vs. time under different loads.

are no longer film forming and can no longer be used as a test film. Figure 7 shows an example of the addition of hexachloroethane to the peroxide.

Effect of Oxidation on Film Strength

In an earlier paper (3) it was concluded that the infrared spectrum of the insoluble, incoherent solid phase of the fixed oils shows a characteristic strong band of unsaturation. In exposing the solids for several days to air at 100°C. This

Table 1
An Example of the Test Tabulations:
Film Coherence Tests on a Soybean Oil Modified Alkyd Resin

Solution	45% Solids
Phthalic Anhydride	34%
Soybean Oil	50%

Curing Time min./100 C	Spring Wire #	Position Before Test	Position After Test	Elongation	Average	Calculated in Grams
I. Film Produced Without Reacting the Alkyd Resin With an Organo Peroxide:						
(Resin Diluted: 100 g Alkyd Solution and 20 g Xylol)						
1) 10 min.	1	33.8	37.0	(3.2)		
	2	34.0	35.9	1.9		
	3	33.9	35.9	2.0		
	4	34.0	36.0	2.0		
	5	33.5	35.7	2.2		
	6	33.4	35.3	1.9		
	7	34.3	36.2	1.9		
	8	34.2	37.0	(2.8)		
	9	33.7	35.5	1.8	1.9	2.45
2) 20 min.	10	34.2	37.2	3.0		
	11	33.8	37.5	3.7		
	12	33.9	36.1	2.2		
	13	34.3	36.6	2.3		
	14	34.0	37.3	3.3		
	15	34.0	36.3	2.3		
	16	34.0	36.6	2.6		
	17	34.0	36.6	2.6		
	18	33.8	(Wire not fully imbedded)		2.8	3.63
II. Film Produced After Heating 100 g Alkyd Solution With 2 g t-Butyl Perbenzoate						
(Fluid Resin Diluted with 20 g Xylol)						
1) 10 min.	1	34.2	37.9	3.7		
	2	34.6	38.7	4.1		
	3	34.2	38.2	4.0		
	4	34.4	39.3	4.9		
	5	34.2	38.8	4.6		
	6	(Wire not fully imbedded)				
	7	34.2	38.7	4.5		
	8	34.2	38.5	4.3		
	9	34.4	38.0	3.6	4.2	5.37
2) 20 min.	10	34.1	39.5	5.4		
	11	34.3	39.0	4.7		
	12	33.9	38.5	4.6		
	13	34.5	38.7	4.2		
	14	34.3	39.5	5.2		
	15	34.3	39.3	5.0		
	16	34.2	40.0	5.8		
	17	33.9	39.4	5.5		
	18	34.0	39.5	5.5	5.1	6.61

band is decreased to a large extent. This indicates that the incoherent, insoluble phase of the fixed oils is still capable of subsequent oxidation. It is known also that films based on fixed oils, or compounds produced from fixed oils, increase in hardness and in oil-resistance when cured for an extended time in an air ventilated oven, and that different compounds differ widely in the extent to which the curing progresses. The film strength tests confirm this oxidation phenomena, as the coherence increases in air more rapidly than in nitrogen. Figure 9 shows that in the curing of a dispersed linseed oil gel, the volatile solvents are evidently more retained in the gelled dispersions, than in conventional resin solution.

Experimental Study

It is to be observed that the three dimensional phase has its own spectrum profiles. Its infrared spectrum is difficult to identify as long as the three dimensional matter has not been isolated and as long as it represents one phase only in a heterophase test specimen, which contains swelling matter of the fluid and the solid phases. In an earlier paper (4) the infrared spectrum of the isolated solid incoherent linseed oil has been compared with the insoluble, but still coherent linseedoil gel. In the gel the three dimensional phase is swollen in still-fluid oil, and, therefore, its spectrum is a composite of the fluid and solid phases. Another method has been found whereby the presence and the development of the three dimensional matter itself appears as a part of a spectrum, even in heterophase conditions. This method makes use of the X-ray diffractometer.

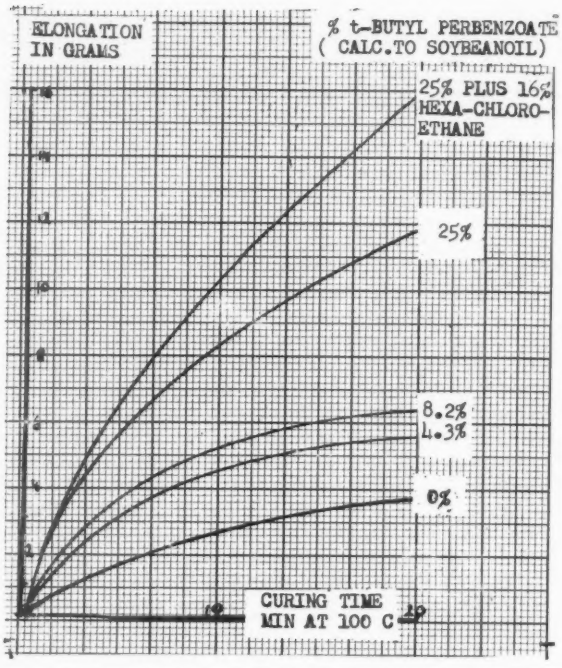


Figure 7. Film coherence tests on a soybean oil modified alkyd.

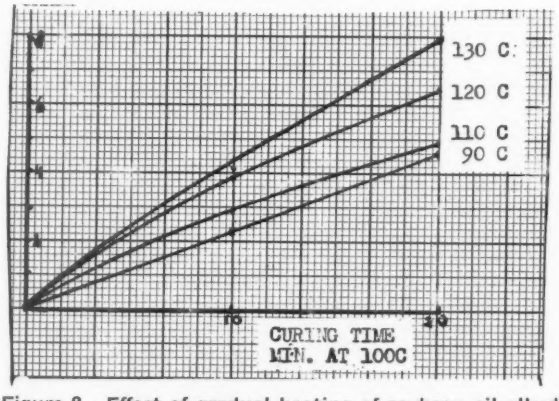


Figure 8. Effect of gradual heating of soybean oil alkyd resin film.

X-ray Diffraction Studies

The development of the three dimensional phase in fixed oils and resins produces in the x-ray diffraction spectrum the formation of a peak region between 30 and 10 degrees, with a maximum peak between 20 and 19 degrees. By the position of the peak, the Angstrum spacing in the test compound can be determined by using the "Tables for the Conversion of X-Ray Diffraction Angles to Interplanar Spacing", as issued by the National Bureau of Standards (5). For instance the X-ray diffraction spectrum of a cured free film of the same soybeanoil modified with alkyd resin has its spectrum peak between 4.4357 Angstrom Units and 4.668 Angstrom Units. The height of the peak can be understood as resulting from the reflectance in the specimen and this again is the result of the distribution of the particles in the specimen. Figure 10 shows the peak of a re-dispersed linseedoil gel and this peak does not change when the same specimen was tested 10 years later. By further mixing the same gel-dispersion with bodied linseedoil, the height of the peak- or the intensity of the reflectance increased with a change in particle distribution. The film

strength increased also. An earlier paper (1) reviewed the effect of the three dimensional solid oil phase, dispersed in the fluid phase and re-stabilized in the form of dried films, on a freshly distilled monostyrene. Where the three dimensional oil phase was in contact with the monostyrene, a solidification of the monostyrene into an insoluble and infusible polystyrene took place. Since the immersed films contained three dimensional units in a coherent sequence, a coherent sequence of three dimensional polystyrene developed and a solidification of the styrene into a film-like or leaf-like appearance was observed.

Figure 11 shows the effect of a soybeanoil modified with alkyd resin (50% soybeanoil) in its film form compared with its film forming stages when reacted with 5.2% and with 8.2% t-butyl perbenzoate. The films were prepared by applying the test solutions in 3 to 5 coats on a strong gummed paper, drying them for one hour at 100°C. and finally aging them at 100 deg. C. for 24 hours. The film was then removed by immersing the film in water at 80 deg. F. and then washing it in warm water to remove all traces of gum and paper from the film. Strips, 3/8 in. wide, were immersed in freshly distilled monostyrene and exposed in an oven at 50 deg. C. The figure shows the polystyrene developments after 132 hours exposure. Tube #1 shows the level of the unreacted monostyrene, tube #2 shows the effect of the immersion of the cured alkyd film, with the resulting growth of a solid, insoluble, styrene film. Tube #3 shows the effect of the immersion of the film produced from the same alkyd, after treating it with 5.3% perbenzoate. Tube #4 shows the effect of the immersion of the film produced from the alkyd treated with 8.2% perbenzoate. In addition, showing the growth of the three dimensional polystyrene, the figure indicates increased turbidity of the coherent styrene gel at the bottom of the test tubes. This turbidity increased with increasing prepolymerization of the alkyd with the peroxide. The fact that the alkyd film without peroxide treatment caused the growth of the styrene film, shows that during the curing of this film some three dimensional matter has been produced. Even here the turbidity of the styrene at the bottom of this tube was of a minor order compared with the other specimen where the peroxide treatment increased the development of the three dimensional phase. The "grown" polystyrene differs greatly from the conventional polystyrene in that it does not melt upon being heated.

Similar immersion tests were made using a 3/8" wide strip which was obtained from the re-dispersion of a linseedoil gel in a cobalt-linseedoil metal soap compound. Here, the grown insoluble polystyrene was compared in its X-ray diffraction spectrum with that of the linseed oil film used as the "seed" material and a surprising similarity was observed.

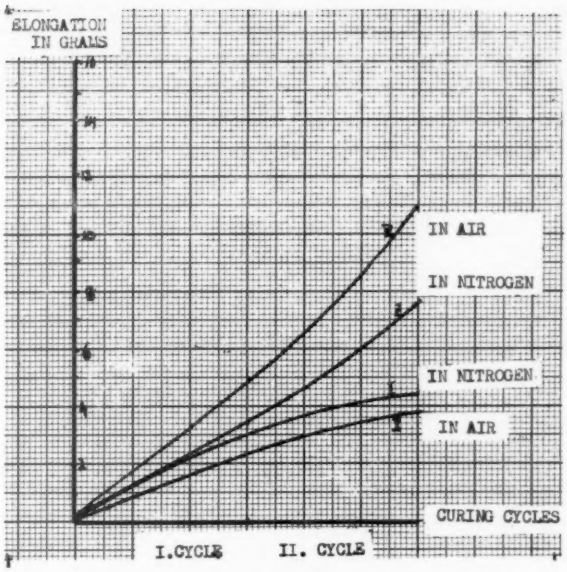


Figure 9. Curing of film of re-dispersed linseed oil gel in nitrogen and air.

Studies Involving Solidified Polystyrene

Since these tests utilize the formation of the insoluble, non fusible polystyrene phase, some additional facts about the styrene solids are being considered. The fact that styrene or styrene-butadiene is capable of forming "hard and granular polymers" or "popcorn polymers" and forming "other benzene-insoluble or gel-polymers" was observed some years ago (6). And the "hard popcorn" formation has often been observed in the bubble cup section of styrene-butadiene polymerization units, where the formation took place from its vapour phase. These products contained small amounts (amount 10%) of still benzene-soluble styrene only.

The grown styrene solids, which are formed by incubation, described in Table 2, are being formed from a fluid phase of the styrene, and therefore they might be described as secondarily formed solids. These contain a greater amount of still soluble styrene. When the grown styrene solids are taken from above the initial styrene level in the reaction tube, as shown in Figure 11, the percent insoluble matter is greater than in the solids which are formed within the fluid styrene. These data are given in Table 2. The appearance of the solids formed within the fluid styrene is shown in Figure 12.

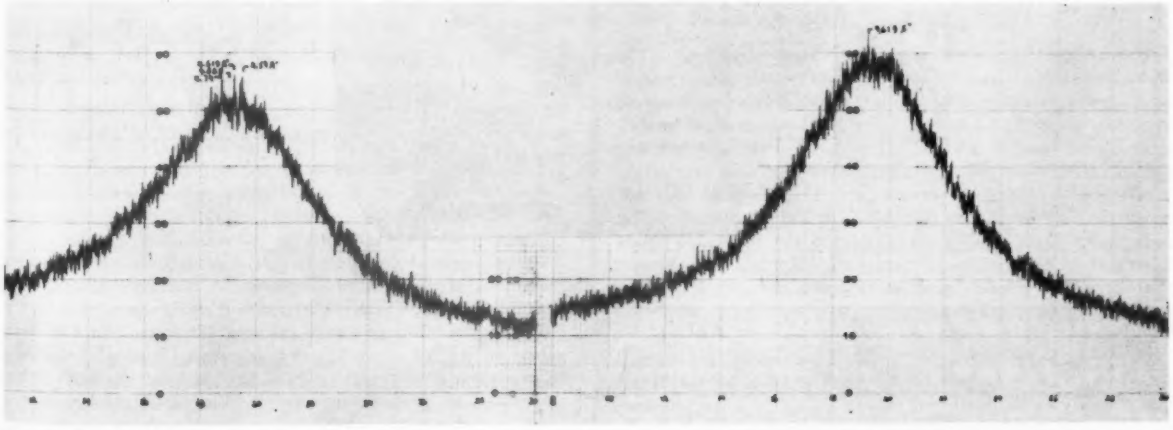


Figure 10. X-ray spectra of a re-dispersed linseed oil gel and the same gel after dispersing in bodied linseed oil.

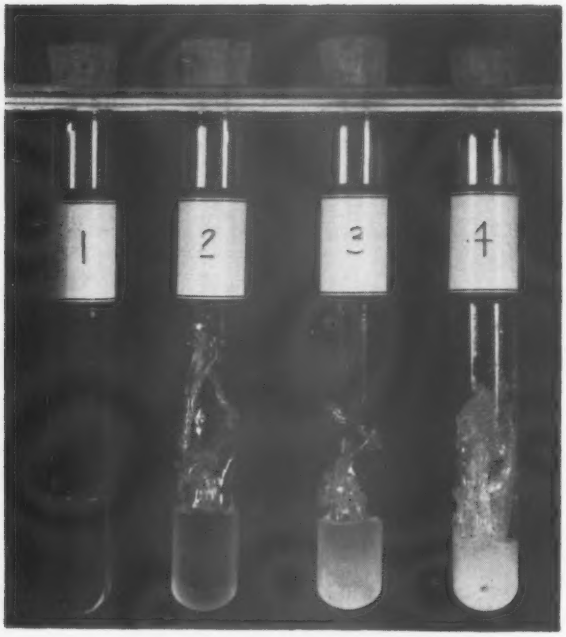


Figure 11. Progressive insolubility of polymer from reacting soybean oil-modified alkyd in styrene. 1-Monostyrene before heating, 2-Heating system with peroxide treatment. 3-Heating with 5.3% t-butyl perbenzoate for 132 hours at 50 deg. C., and 4-Same as 3 except with 8.2% t-butyl perbenzoate.

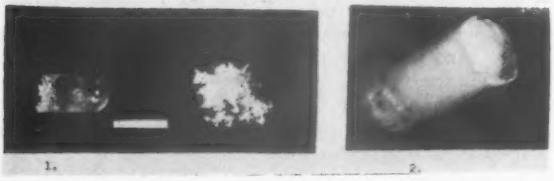


Figure 12. 1-Straight polystyrene. 2-Gelled product formed from styrene and gelled linseed oil.

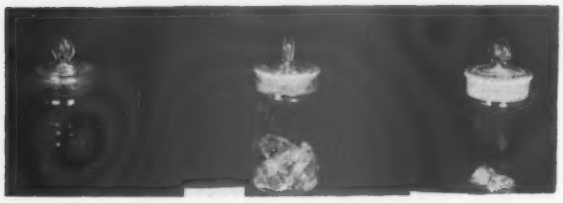


Figure 25. Left-linseed oil gel, center-swollen styrene gel, and right-styrene gel in dry state.

The tendency of linseed oil solids to cause the growth of the insoluble styrene solids by incubation is not affected by various pre-treatments of thise solids. Table 3 gives an example of solids which had been exposed to the vapors of a considerable amount of distilled styrene and which did not lose the effect of causing the growth of styrene solids after when incubating in liquid styrene. And these solids did not cause the styrene vapors to solidify in the distillation. The same table shows another example of the linseedoil solids having been exposed to formaldehyde vapors. It is known that linseedoil gel can react with formaldehyde, but these solids maintained their capacity to cause in styrene the development of the incoherent solid phase.

If the insoluble, unshaped, coherent linseedoil gel is used for incubation instead of the incoherent type, an unshaped and strongly swelling styrene gels develops. The preparation of this gel is shown in Table 4 and the product is shown in Figure 13.

Table 2

The Preparation of the Grown Styrene Solids:

0.75 g. Insoluble, Incoherent Styrene Solids, Such as Formed From the Vapor Phase of Styrene or Styrene-Butadiene

or

0.75 g Insoluble, Incoherent Fixed Oil Solids, As Obtained From Reacting a Fixed Oil with an Oragano Peroxide

Incubated In

15 g. Freshly Distilled Monostyrene, at 50 C.

Solids are Partially Growing Above the Styrene Level, Partially In the Styrene.

Separation:

The Grown Styrene Solids were Washed First with Ether Petroleum and were Stored 120 Hours in 100 g Benzol, Decanting the Benzol Every 24 hours. Finally, Solids Dried several hours under Vacuum.

% Styrene Solids Found:

From Material grown above the Styrene Level.....Test I. 36.85% Test II. 37.62%

From Material grown in the Styrene..... 27.51%

Table 3

The Influence of the incubation of linseed oil solids having different pre-treatments of the growth of styrene solids.

I. The Linseed Oil Solids were obtained by heating bodied Linseed Oil with an Organo-Peroxide. They were washed several times with boiling Toluol, then with Ether Petroleum and dried in vacuum.

II. The Linseed Oil Solids were exposed to the vapors of Styrene by exposing 0.75 g. solids to the distillation vapors of 80 g. Styrene. They were then incubated in freshly distilled Monostyrene.

III. The Linseed Oil Solids were stored for 18 hours in Formaldehyde vapors, obtained by heating Paraformaldehyde in the flask in which the solids were suspended. After the vapours were flowing over, the container was closed, heated again and kept closed for 18 hours. The solids were then exposed to air for 2 hours.

The % Insouble Styrene Solids Obtained from the Incubation of 0.75 g. Linseed Oil Solids in 15 g. Monostyrene (96 Hours at 55 C.)

Sample #	Linseed oil Solids Used (0.75 g/15 g Styrene)	Grown Benzol-Insoluble Styrene Above Coherent Level %	Grown Benzol-Insoluble Styrene From Coherent Product %	Average %
a	From Treatment I.	47.11	33.60	37.62
b	From Treatment II.	46.61	32.78	38.46
c	From Treatment III.	46.04	34.13	39.42
	Average	46.59	33.50	38.50

These tests indicate that the formation of heterophase conditions containing different phases of soluble and of swelling and of incoherent polymers is not limited to the field of fixed oils. The close chemical or physical interreactions between polymers of one group and of the other group will be studied in the future.

CONCLUSIONS

The experiments indicate the following findings:

1. It is possible to produce from the group of materials which have been studied a three dimensional, insoluble, non fusible, non molecularly dispersible phase directly from the liquid and soluble or molecularly dispersible phase. In the case of polyhydroxyl alcohol-fatty acid esters (fixed oils) this can be performed by the use of a satisfactory amount of an organo peroxide and by its energy release. In the case of a highly conjugated fixed oil it was obtained from exposure to gamma radiation also. In the case of the monostyrene it is

Table 4

Preparation of the coherent, insoluble, swelling gelled polystyrene by incubating gelled linseed oil in monostyrene at 50°C.

The Linseed Gel: Prepared by heating bodied linseed oil, while blowing air through the oil, at 300°-310° C. for 3 hours until gelation occurred.

Insoluble matter in gel determined by storing 7 g. gel in 25 g benzol for 48 hours, changing the benzol after 24 hours to remove ungelled oil. The remainder heated in boiling benzol (125 g.) for 10 minutes. benzol decanted; gel washed with cold benzol and dried 48 hours at 55°C.

Obtained: 2.3952 g. or 34.22% hard, unshaped dry solid matter.

The Styrene Gel: Prepared by incubating 0.5 g. linseed oil gel containing 34.22% insoluble matter, in 8 g. monostyrene. styrene gelled after 50 hours at 55 C. Exposure continued to a total of 276 hours.

The styrene gel is not granular and swells with benzol strongly. After boiling it in Toluol four times and drying it at 110°C., 2.7 g insoluble matter was obtained.

Considering the 0.17 g insoluble matter contained in the incubating linseed oil gel, the styrene residue represents. 2.7 g.-0.17 g. or 2.53 g. or 31.6% of the initial monostyrene:

possible to obtain this solid, insoluble phase from the incubation of small amounts of three-dimensional incoherent matter, either from styrene itself or from the fixed oil solidifications.

2. When the reaction is not carried out—or is not possible to be carried out—directly from the initial to the ultimate phase, a group of heterophase conditions is being formed where the initial phase is present together with increasing amounts of the ultimate insoluble phase. Interim developments can also be present, such as products showing an increasing degree of conjugation between the area of unsaturation. This development has been shown in the case of peroxide application to fixed oils, as well as the result of exposure to gamma radiation.

3. The heterophases which contain considerable amounts of the initial phase, or its gradual conjugated forms, and contain small amounts of the insoluble, incoherent, three dimensional phase are either fluids of increasing viscosity or they turn into coherent gels. The difference between a highly viscous phase and a gel is in the fact that the highly viscous phase can be diluted into a lower viscous heterophase material by the addition of more initial-phase matter, or of other solvents, without a detectible increase in volume due to swelling. The gel is no longer molecularly dispersible, due to its increased amount of three dimensional substance, and shows in contact with fluid media, or swellers, an increase in volume. Both remain coherent, or in the case of film forming materials, they remain film forming.

4. When the content of the insoluble, three dimensional substance increases to the point where the solid matter appears for itself, this matter is no longer coherent and no longer film forming.

5. It is known that it is possible to re-disperse gels and oil solids in the fluid phases by heating them with metalsoap compounds (1). These dispersions also can be seen as heterophase conditions, since the dispersion still has the same x-ray diffraction spacing as the insoluble gel, in spite of the fact that these dispersions can further be diluted and maintain in the diluted form their viscosity for a long time. By mixing such re-dispersed gels with earlier-phase oils, such as bodied linseed oil, the resulting dilutable matter shows a further dispersion of the three dimensional matter in an increasing reflectance of the x-ray diffraction and in the increasing coherence of the resulting films.

6. The polymerizing materials behave differently in their tendency to develop the incoherent, solid, three dimensional phase in a free form: monostyrene develops the solids by incubation of small amounts of solids, as under the influence of "seeds", and solid linseed oil can act as such a seed. But neither the same solid linseed oil nor the solid polystyrene can act as a similar seed when incubated in fluid linseed oil. The reason is that different materials evidently require different amounts of energy in changing from one phase to another. These conditions require additional investigation for an extended group of materials and eventually with different forms of energy application.

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(4) See Reference (3) above. Figures 4 and 5, pages 17 and 18.

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This research work has been undertaken under Research Grant G-6027 of the National Science Foundation. The authors express appreciation for this assistance. Also the authors wish to express appreciation to Sub-Committee 71, New York Paint and Varnish Production Club, of which Dr. Kronstein is an active member, for releasing some of the exposed oil samples.

This paper was presented at the 137th National Meeting of the American Chemical Society in Cleveland in the Division of Paint, Plastics and Printing Ink Chemistry.

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Ask your Cal Ink representative for a complete booklet of these "helpful hints."

By
Edward Anthony

The author expresses his random reflections on various aspects of the paint industry. The opinions contained in this column are his alone and do not necessarily reflect those of this publication.

Reassessment

THE stupendous economic growth of the past decade and one-half has gained for this country's inhabitants a material prosperity unmatched in the history of the world. The year just gone by has however seen a slackening in the pace of this dynamic upward movement. There is little doubt that the image of the *soaring '60's*, while somewhat dimmed, beckons invitingly.

Growth and change have been pointed out as the enduring characteristics of our free economy (H. C. Wallich, *Think*, 1960). As symbolized by the Gross National Product this growth has been remarkable for its consistency. The increase in G. N. P. per capita was 1.55 per cent per year from 1839 to 1879; from 1919 to 1959 it was 1.64 per cent. These figures are an indication of an increase in productivity—as much the result of greater human endeavor as from the influence of the industrial revolution, evidenced by the stability of the rise over more than a century.

This decade will be marked as much by the prospective tremendous growth of the labor force as by any other factor. During the '50s an annual average of 800,000 people were added to the wage earning community. The '60s will see this figure double—the result of the sharp contrast in the birth rate of the '30s compared with the '40s.

Where have pace setting expansions shown the timbre of our thinking? Expenditures for education and scientific research have grown twice as rapidly as the rise in G. N. P. during the past ten years. There are over 1,400,000 classroom teachers and 200,000 college professors training our youngsters today, according to the National Education Association and the Bureau of Labor Statistics. The B. L. S. reports that there were about 815,000 technically trained persons employed in industry in January 1960, 80 per cent of whom were engineers and 10 per cent chemists (*Chemical and Engineering News*, Dec. 19, 1960). Further, it was predicted that by 1975 this group would number two million. This would be the largest increase in the professional and technical fields, which are undergoing such rapid expansion that one of every seven workers will be employed in these highly specialized endeavors in fifteen years.

The emphasis on advance through scientific exploration in the chemical industry is pointed up by the fact that nine per cent of the total number of employees are scientists and engineers. The comparable figure for all industry is 2.7 per cent. And the result? The Manufacturing Chemists' Association reports that production by the chemical industry doubled between 1950 and 1960; the Federal Reserve Board's Index of Industrial Production for all manufacturing went up by 50 per cent during the same period of time. The growth rate of the chemical coatings industry followed the latter pattern rather than the former.

This reflects the great advances made by other protective and decorative methods. Plastics have replaced painted metal objects and parts; melamine laminates are used where once lacquered or varnished wood was supreme; anodized aluminum's chemically produced color usurps a coating application; vinylclad steel and vinyl-coated fabric have made deep inroads into markets once the province of organic finishes. And just as, in the past, our coatings replaced two-coat porcelain finishes, the development of a one-coat porcelain finish now challenges the organic coating in some areas of use.

As a result of continuing research thinner layers of paint are required to achieve superior properties. More ingenious methods of application have minimized losses. All in all, competition comes not only from without but comes also from the fact that a gallon of paint goes a lot further today than it did yesterday. Couple this with the increasing struggle for the consumer's dollar by the many varied demands of the affluent society, the ever changing tastes and modes of a never predictable public—and you then realize the necessity for continuing efforts to produce and market desirable protective and decorative systems.

Progress

HERETOFORE chemical coatings could be classified as nonconductors. By the use of special pigments it is possible to reduce the resistivity of a finish to a relatively low value and thus make a product that could serve, for example, as an adequate base for application of a topcoat by electrostatic means on such an insulating surface as wood or polyester. But now visualize polymers that actually readily conduct electricity. Imagine the potential (!) of such a product as the key to a new approach to printed circuit manufacture.

These resins are not quite ready for commercialization but, like much else, they will be in time. A team headed by Dr. A. Wasserman of University College, London, starts with colorless monomers such as cyclopentadiene. Using a catalyst—trichloracetic acid has been the favorite so far—they produce, through a Diels-Alder mechanism, deeply colored polymers which are conductive in benzene solution (*Chemical and Engineering News*, Dec. 9, 1960, p. 46). Conductance in the solid state is their next goal.

An old product that will have to make way for the new is radium (which is not so old, itself!). The latest self-luminous paint utilizes tritium's property of emitting beta particles to excite a crystalline phosphor (*C & E News*, Jan. 2, '61). The tritium is chemically bound to a transparent resin which in turn is coated with the phosphor. The glow produced on markers, knobs, dials, etc., is quite safe since there is no detectable radiation at the surface.

These are but two of many new approaches which are broadening the range of the usefulness of surface coatings. Making a product to satisfy a new need or improving on an older finish so that this industry may compete with the creations of our competitors—these are avenues of expansion as well as survival. And other industries in fighting their battles sometimes help us.

The competitive struggle between wood and plastic laminate panels entered a new phase with the recent announcement of the Fine Hardwoods Association's *Finishield* process (*Plywood*, Aug. 1960, p. 16). By combining either a catalyzed epoxy or catalyzed polyester top coat with an aluminum foil underlayment for the veneer, a system has been developed which offers "the beauty and authenticity of genuine wood on all surfaces, with all of the resistance to cigarette burns, abrasion and solvents claimed by competitive materials—and at less cost!"

Tests conducted by the Timber Engineering Company laboratory indicated that the epoxy and polyester finishes are noticeably superior to lacquer and catalyzed alkyd-urea formulations. And in comparative tests these formulations offered equivalence to laminated plastic in such specific properties as resistance to acids, alkali, organic solvents, water, fats, and cleaning agents, as well as in physical qualities viz., adhesion, abrasion, cold check, humidity, impact, and mar resistance.

The foil is pre-coated with a special adhesive designed to insure proper bonding with the veneer and core layers. Its function is to rapidly dissipate the heat generated by lighted cigarettes, hot dishes, etc., to prevent burning of the coated surface.

The *Finishield* system is an example of the marketing approach to paint formulation which has been

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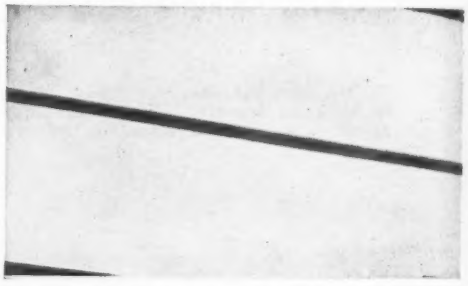

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ONCOR® T15 (lead silico titanate pigment)		300.00	8.90
Zinc oxide, acicular		250.0	5.32
Magnesium silicate		150.0	6.30
FOAM-A® (barytes)*		250.0	6.75
BENTONE® 38 (gelling agent)		3.0	0.20
		953.0	27.47
Vehicle			
Methanol/water (95-5%)		0.9	0.13
Linseed oil, raw		360.0	46.63
Linseed oil, pale heat bodied, Z2 visc.		120.0	15.0
Mineral spirits		75.0	11.44
Liquid drier		20.0	2.90
		575.9	76.10
	TOTALS	1528.9	103.57

PVC: 30.83% • Weight per gallon: 14.76 lbs. • % Vehicle: 36.67.
Consistency: 88 KU • % Pigment: 62.33 • % Volatile in vehicle: 16.65.
*National Lead Company, DeLore Division, St. Louis, Missouri

The above data have been developed in our laboratories and are believed to be correct.

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emphasized in this column. In the words of the *Plywood* article, "Here is a chance for wood interests to incorporate new strong sales points into their products. They are sales points which competitive materials used to gain initial footholds. They are sales points not customarily associated with wood." This is the crux of the matter: to attempt to orient your product to the desires of the consumer.

Tall Story

WE are all constantly aware of our industry's position as a supplier of a type of product that is but another intermediate item to many of our customers, particularly for the 40 per cent of our near-$2 billion per year sales which are categorized as industrial finishes. It is comforting to know that our coatings are usually the *last* step in the manufacturing procedure and the *first* thing the consumer notices. This is a great responsibility.

Consider for a moment the situation of an industry for whose product we are the largest outlet, the tall oil fatty acids producers. We take their end-product, cook it into a resin, then use that as the unrecognizable vehicle in a finished paint product. Try explaining to the little woman *that* sequence when she asks what you do!

But seriously, this is an industry with the capacity to fractionate about one billion pounds per year of its raw material, derived from the process which produces kraft paper. The yield is about 27 per cent of the input, as finished fatty acids. Production has climbed from only 5 million pounds in 1950 to about 150 million in 1959 and is predicted to reach above 200 million by '65 (*Chemical Week*, April 16, 1960, p. 111).

Protective coatings take 30 per cent of the total consumed. Intermediate chemicals (23 per cent) and soaps, detergents and disinfectants (21 per cent) are the next largest outlets. For the most part the use in the paint industry is confined to the manufacture of alkyd resins. Quality of these vehicles is constantly improving and the price differential between tall oil fatty acids and soybean fatty acids is in favor of the former. Thus there is competition between these two ingredients for a market whose growth is slowing down. This plateau of usage is, in its turn, caused by the increasing importance of water-based coatings, specialty finishes, and so forth.

•

Tennessee to Build New Petrochemical Plant

Tennesse Gas Transmission Co. will build a multimillion-dollar petrochemical plant on its Houston Ship Channel property.

This was disclosed as Tennessee Gas in Houston and Cary Chemicals, Inc., in East Brunswick, N. J., jointly announced a long-term production and marketing association.

At the same time Cary announced plans for the expansion of its vinyl polymer, compounding and calendering facilities, as part of a program to make it one of the largest producers of vinyl products.

Cary will continue as an independent, publicly-owned corporation in which Tennessee Gas will have a substantial interest.

The diversification of Tennessee Gas into petrochemicals, and Cary's expansion program, will be closely integrated. Tennessee Gas is one of the nation's principal handlers of natural gas and light hydrocarbons, while Cary is one of its largest manufacturers and marketers of polyvinyl chloride-based plastics and related materials.

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Weight per gallon—pounds	33.7	Retained on #325 Mesh Sieve, %	0.3
Oil absorption—(gms. per 100 gms.)	30	Lead oxide (PbO), %	43.0
Color	Off white	Silicon dioxide (SiO_2), %	42.0
Tinting strength	200	Titanium dioxide (TiO_2), %	15.0

HOUSE PAINT TINT-BASE FORMULATION FOR LIGHT-TINTED HOUSE PAINTS

Pigment T-10670	Pounds	Gallons
ONCOR® T15 (lead silico titanate pigment)	300.0	8.90
Zinc oxide, acicular	250.0	5.32
Magnesium silicate	150.0	6.30
FOAM-A® (barytes)*	200.0	5.40
TITANOX RA-NC®**	50.0	1.43
BENTONE® 38 (gelling agent)	3.0	0.20
	953.0	27.55
Vehicle		
Methanol/water (95-5%)	0.9	0.13
Linseed oil, raw	360.0	46.63
Linseed oil, pale heat bodied, Z2 visc.	120.0	15.00
Mineral spirits	75.0	11.44
Liquid drier	20.0	2.90
	575.9	76.10
TOTALS	1528.9	103.65

PVC: 30.89% • Weight per gallon: 14.75 lbs. • % Vehicle: 37.67.
Consistency: 86 KU • % Pigment: 62.33 • % Volatile in vehicle: 16.65.
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COVER STORY

Glaser Sees New Application Techniques, New Substrates Contributing to High Obsolescence of Industrial Finishes

DURING the past decade, industrial finishes in common with many other products have suffered from a high incidence of obsolescence, according to Milton A. Glaser, Vice President and Technical Director of Midland Industrial Finishes Co., a firm concentrating on "specialty" markets in the organic finishes field.

A major factor in this trend toward obsolescence, Mr. Glaser said, "has been the large number of new chemicals, new polymers, pigments, etc. Another important reason for our high obsolescence index has been the relentless drive of users of industrial finishes to employ many new substrates, new coating and curing equipment and to produce articles of commerce which have never been made before," he said.

"In the area of new raw materials, the acrylic polymers have made notable progress in automotive and appliance finishes," he said. "The epoxy-based coatings," Mr. Glaser continued, "have found wide usage in chemical-resistant materials, in appliance primers and in highly abrasion-resistant coatings for many end uses. Silicone polymers and copolymers have found increasing adaptation to high temperature and electronic applications and for exterior coatings of superior durability.

"Polyurethane finishes are finding increasing markets as highly abrasion-resistant finishes for floors and as water-resistant finishes for boats, etc.

"Polyester finishes are being developed for use on furniture and other objects and may capture part of the U.S.A. market for furniture just as these finishes have done in Europe," he said.

Water-soluble and emulsion-based industrial finishes, he continued, "are beginning to be used in increasing quantities.

"New variations of such aqueous materials are being introduced constantly. The field of vinyl resin coatings, although not entirely new by itself, has shown consistent advances. Special vinyl-phenolic compositions have been evolved to produce superior container and closure linings.

"Vinyl organosols and plastisols—particularly the types requiring no primers—have recently made a vigorous impact on the organic finishes market in this country because they 'out perform' more conventional coatings in many fields of application—and at very competitive prices!

"The continual introduction of new solvents, new pigments, new polyols, new dibasic acids, new processing and application equipment—all these factors have combined to greatly extend the scope of paint chemistry and the variety of products which our industry can make," Mr. Glaser said.

"Of equal importance with the newer chemicals and equipment available to the organic coatings industry, is the research-oriented awareness of many in our industry's management. I believe that our company managements are expending a larger proportion of each sales dollar for research and development than ever before," he said.

"These then are the current trends in industrial finishes—accelerated obsolescence of the older coatings with the stimulating newer and better products created by our laboratories from novel molecules and concepts, produced by our factories with improved equipment and machinery and utilized by our customers over a larger variety of substrates by new and speedier application equipment," he concluded.

Having first joined the firm in 1945, Mr. Glaser became Vice President in 1949 and Director of the company last year. He is a member of the American Chemical Society, American Oil Chemists Society, has served as President of the Chicago Society for Paint Technology in 1945-46, and the Federation of Societies for Paint Technology in 1956-57.

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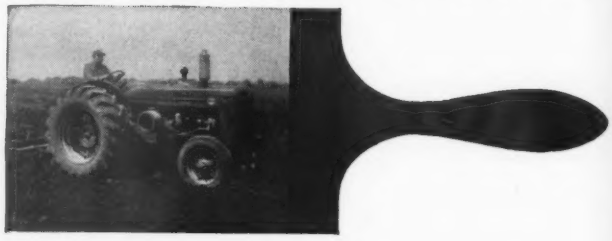

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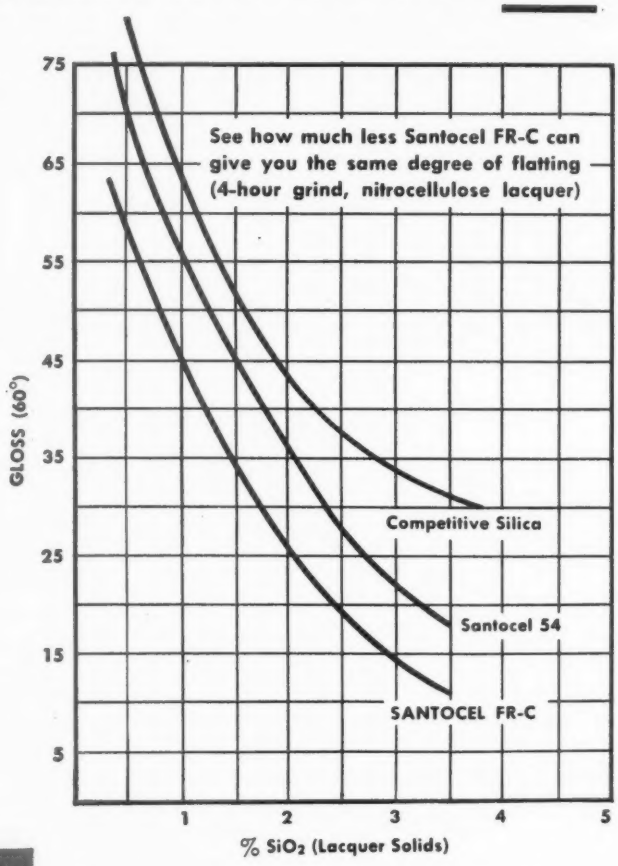

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Oil Absorption (Gardner-Coleman) 53-58
Water Absorption (cc's per 100 grams) 150-200
KU Range (Oil-base Paint Test Formula) 95-110

ASBESTINE 525 further improves products because it is a chemically inert, stir-in pigment with excellent wetting and suspension properties and good white color. Paint films exhibit toughness, good adhesion and improved sanding properties.

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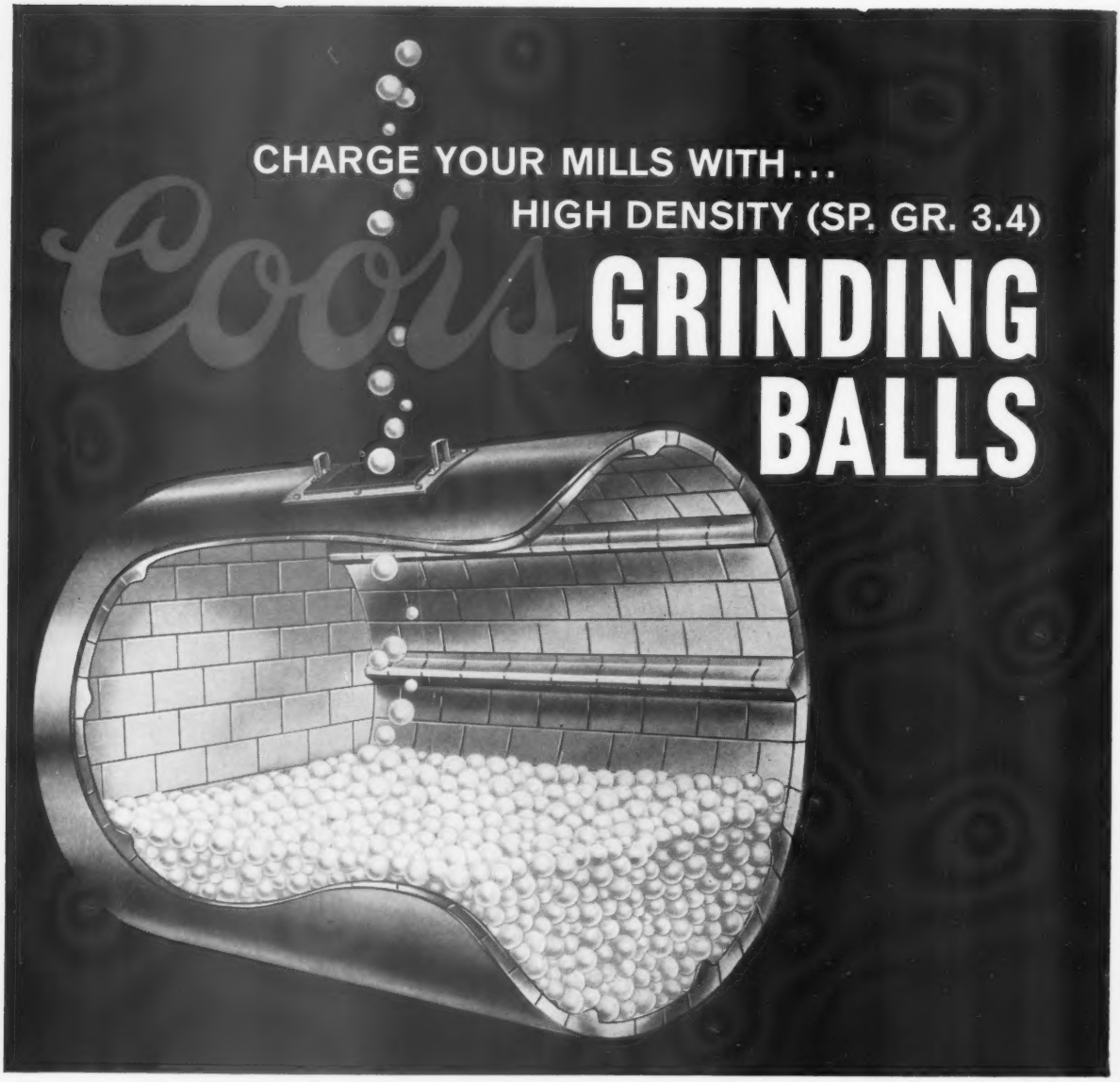

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PRODUCTION

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MATERIAL HANDLING

NEW EQUIPMENT and MATERIALS

Efficient blending of ingredients is a "must" for manufacturing high quality cement base paints, according to U. S. Protective Coatings of Baltimore. With the Entoleter Centrifugal mixer, it is now possible to produce an intimate, smooth-textured blend in which the color of the mixture has been intensified and enriched. For details, see page 71

Important news
for users of 2-gallon pails –

Milton introduces the TINSTEEL pail, a major breakthrough in pail production—one which cuts your handling costs, slashes dealer returns and helps boost your sales!

WHAT makes new, Milton 2-gallon TINSTEEL pails so special? Several important things:

1. Milton TINSTEEL pails are made of heavy gauge *tin-plate*. This eliminates the possibility of coating flaws inside or outside the pail. Spoilage is reduced.

Another factor in this regard is TINSTEEL pails' 12-lug covers. They fit each pail tightly. This, plus minimal "headspace," reduces the possibility of skinning.

2. Because they are made of tin-plate, Milton TINSTEEL pails can be lined with the same material that has proved so successful in gallon and quart cans used for emulsion paints.

3. Thanks to special machinery, new, TINSTEEL pails come in a range of sales-attracting colors! (Left uncoated, tin-plated TINSTEEL pails stay bright, fresh-looking, attractive.)

4. TINSTEEL pails come to you packed in the same type of kraft paper bags which have proved so practical over the years for packing smaller sized paint cans. Net result? Empty, TINSTEEL pails are handled and stacked as easily as smaller paint cans.

5. Another factor recommending Milton 2-gallon TINSTEEL pails is their unusual strength. The heavy gauge steel under their bright tin-plate makes them endurably rugged.

Also, Milton TINSTEEL pails have *straight* sides. This gives them *vertical* strength, makes them resistive to waste caused by damage in handling and stacking.

6. Because production varies seasonally, many successful firms prefer to hold materials stocks to a minimum, ordering additional items as needed.

You can follow this profitable practice secure in the knowledge that fully automatic equipment enables Milton to deliver all the 2-gallon TINSTEEL pails you're likely to need to keep production flowing smoothly. (Milton can now turn out enough TINSTEEL pails daily to meet the total requirements of *all* users!)

Of course, there are other advantages, too, in buying 2-gallon TINSTEEL pails—and smaller sized cans—from Milton. Consider these:

Milton service is quick. Often you receive delivery within 24 hours after you call.

Milton 2-gallon TINSTEEL pails are available for shipment with other can sizes in mixed carload and truckload lots or almost any fraction thereof.

Milton containers are moved from the carrier into your plant on dollies. This mobilizes receiving and speeds unloading time. The entire operation proceeds with minimum use of your manpower. Dollies are left in your plant until the next Milton delivery; this facilitates movement of cans from storage point to production line. Again, both time and labor are saved. (This service is available within trucking radius of New York City.)

For all these advantages, Milton TINSTEEL pails are competitively priced.

Whether you presently use 2-gallon pails, or may someday, find out more about the superior, new kind Milton makes. And for all types of cans—lined, unlined, plain, lithographed, standard and made-to-order, enjoy the time-saving, dollar-saving advantages of dealing with Milton. A trial order will convince you. Call today. EVergreen 3-1100.

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GROUP CREATIVE THINKING

By
Lawrence Shatkin

WASHINGTON Irving stated, "some minds seem almost to create themselves, springing up under every disadvantage and working their solitary but irrestible way through a thousand obstacles." The survival of a company depends upon better and better performance through innovation, creativity, invention and discovery. These activities are advanced when managers and scientists are encouraged to think creatively. The power of new ideas is dependent as to how far one has the ability to put his imagination to work. The whole area for inspiring creativity is done along individual and group programs, with no single process regarded as a panacea.

The Right Atmosphere

The creative process is important to business and greatly influenced by the existing business environment where the manager works. Management policy should allow the individual lateral and vertical movement within the organization to pursue and follow-up ideas. The organization chart should not become an obstacle, because changes occur shortly after such a chart is depicted. Everyone has some creative ability and it is important to tap this reservoir of ideas.

Group Creative Thinking

During the nineteenth century most of the great inventions or discoveries were made by individuals. During the twentieth century these were mainly accomplished by teams of researchers.

The primary aim of individuals or groups is the flow of new ideas and the stimulation of one's imagination. Group thinking is not to supplant original individual thinking, if the latter is desired. Such a decision must be made by top management. However, there are many areas where group thinking has been successfully used.

Group creative thinking is a method of encouraging groups of people, with wide experience and latitude, uninhibited and unhampered, to develop imaginative solutions to problems. It is more than a device for stimulating promotional ideas. It is an opportunity to assemble knowledgeable and qualified persons, of varied background to probe and solve continuing business problems. It is not a substitute for clear and logical analysis and synthesis demanded of the individual original thinker.

Types of creative thinking sessions are:

1. The free association approach
2. The orderly or step-by-step approach
3. The broad field approach

"Brainstorming" Approach

How often have we heard such statements as "two heads are better than one," or "a little knowledge is a dangerous thing." I think a little knowledge is a useless thing and two heads are better than one providing they are working in a properly organized way. This leads us to the concept of synergism, which is defined as the "cooperative action of discrete agencies such that the total effect is greater than the sum of the two effects taken independently."

Brainstorming is the crux of the concept of synergism. Alex Osborn in his book "Applied Imagination" cites four basic rules that should be used in brainstorm sessions. These are:

1. Criticism is ruled out;
2. The wilder the ideas, the better;

The opinions expressed in this feature are not necessarily those of any particular firm or organization.

3. Quantity is wanted;
4. Combination and improvement are sought.

Brainstorming has helped solve marketing problems and provided a feed-back of attitudinal information of salesmen in the field, and has also been used in new product planning.

An oil company stated that such a program served three purposes:

1. To solve specific problems;
2. To improve sales effectiveness;
3. To develop "sales imagination."

In all of these sessions no one right answer is sought. Rather, an array of answers are wanted without any rigid controls regarding their usefulness or their being logical. The evaluation of these ideas are postponed until another session, and possibly with another group.

It is suggested that these sessions be comprised of six to twelve persons and run for one-half to one hour. In addition, persons of widely different ranks should not be part of the same group.

The Orderly Approach

This type of thinking session focuses on defining the problem, gathering facts in order to analyze the problem, which in turn should present several alternatives toward the solution of the problem. An evaluation should bring about the best approach which is finalized when the solution to the problem is put into action.

I believe the most important step in any problem-solving activity is to arrive at a clear statement of the problem.

The Broad Field Approach

The underlying concept rather than the problem itself is probed, bringing in social, ethical, aesthetic, and economic values along with the technical and mechanical aspects of the problem.

What is Innovation?

Innovation is bringing about a purposeful change through new configuration of known elements. It is dynamic and a constant changing quantity, which is developed through unhampered thinking and by the elimination of precedent.

We have to develop strict processes of the imagination. We have to build a discipline of the imagination which is not essentially analytical—which is imaginative, and yet strict, and capable of being organized and put to work instead of waiting for the Muse to hit us.

Criticism of Brainstorming

1. Tends to produce superficial ideas;
2. Evaluation is put off indefinitely;
3. Tends to be haphazard and disorderly;
4. Tends to be used as a substitute for individual thinking.

Creativity is essential for survival. We must encourage enthusiasm in tackling problems which will bring about an eagerness to solve problems. An open mind for new ideas must prevail.

The personnel manager of a large paint producer sums up brainstorming's persuasive power this way: "The brainstorming session is a shock treatment. Even if it didn't produce a single useable idea it would pay its way in jolting us from our narrow methods of problem solving."

The urge to de better lies deep inside us all. Let's bring it to the surface!

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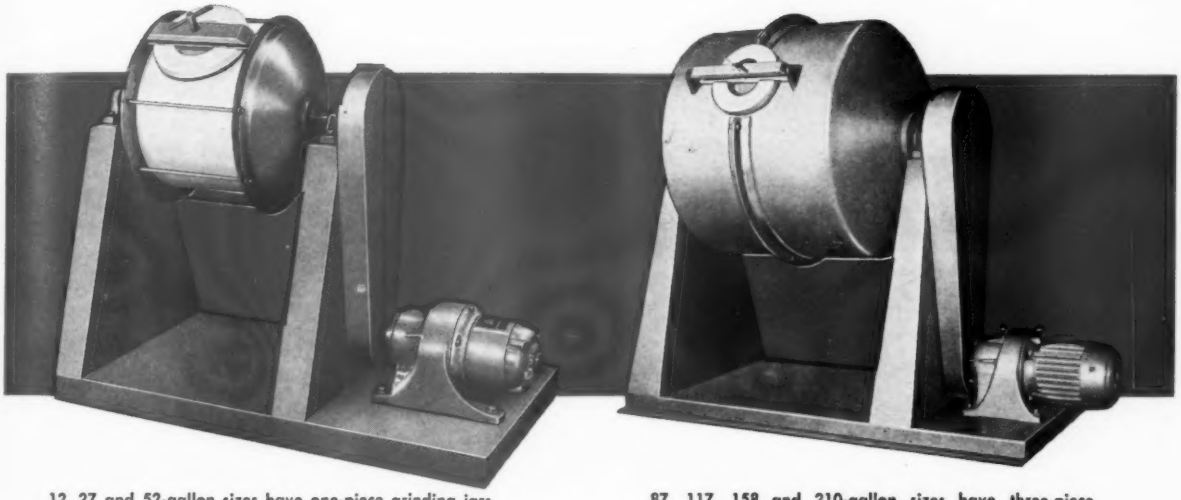

12, 27 and 52-gallon sizes have one-piece grinding jars securely held by dome-shaped steel heads and heavy steel tie rods.

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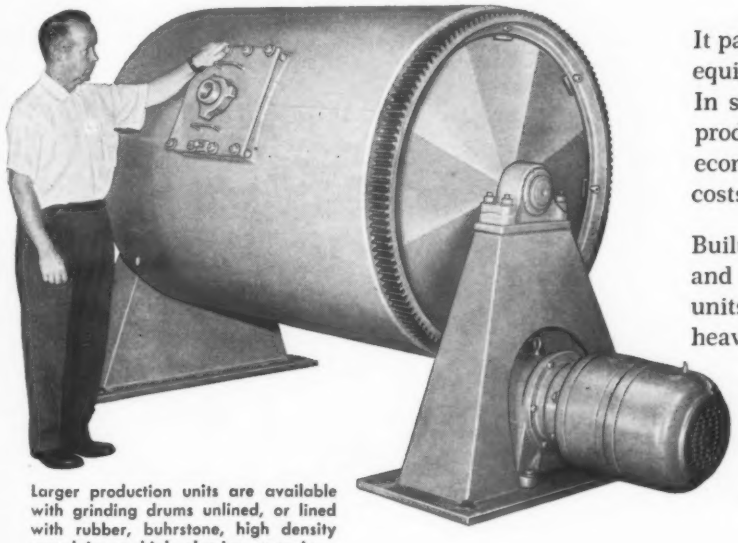

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It pays to replace obsolete, inefficient equipment with dependable "U. S." Mills. In small laboratory batches or full production, you get easier, faster, more economical milling. Uniform results cut costs, assure better quality control.

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HANDY HINTS ON MILLING

A fast, easy way to clean your mill after wet or dry milling is by wet milling with a charge of flint sand and grinding media. After discharging, rinse mill with water.

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DRY BLENDING of POWDER PAINTS

Centrifugal mixer provides proper dispersion of colors.

THE manufacture of quality cement-based masonry paints, as done by U. S. Protective Coatings, Inc., of Baltimore, Maryland, requires intimate mixing of the finest ingredients. The company's "Protect-a Crete" and "Protect-a Block" masonry paints meet Federal Specifications TT-P-21, Type 1 and 2, A and B.

The explanation of this quality, according to R. L. Henry, President of U. S. Protective Coatings, is simple: Use only the best raw materials and blend them with the most efficient mixing equipment available.

Illustrating what Henry means by quality ingredients, "Protect-a Crete" concrete paint contains three per cent titanium dioxide to give the coating good wet-hiding power (the under surface will not show through when it rains). Reground white portland cement is used to give the paint greater

Figure 1. The proper proportions of each ingredient for the cement-based masonry paints are weighed, then dumped into a mixing hopper.

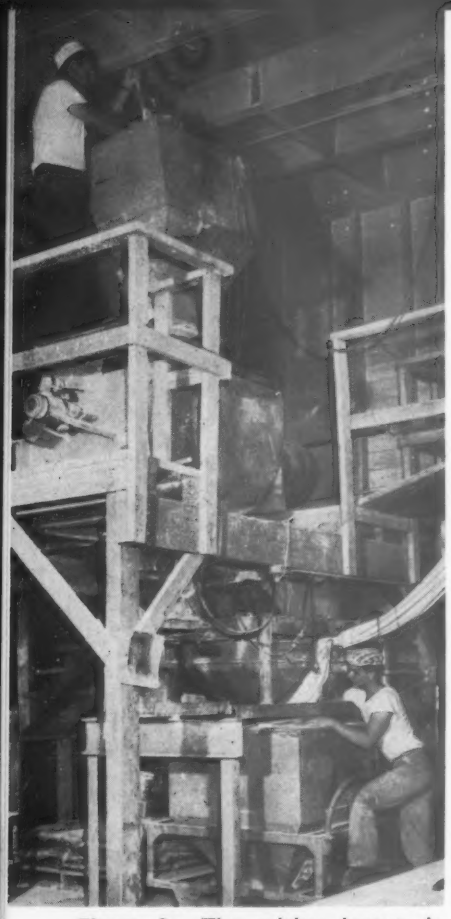

Figure 2. The mixing hopper is wheeled to the mixing station where a hoist elevates the hopper into position over the ribbon blender premixer.

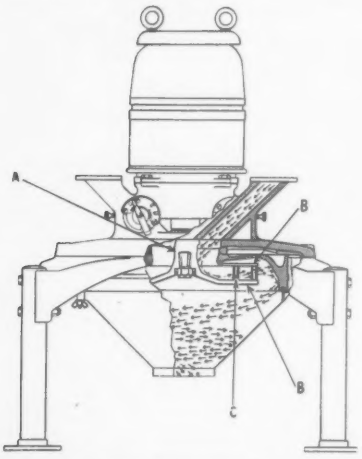

Figure 3. The Entoleter Centrifugal Mixer uses high-speed, high-energy centrifugal action for dry homogenization. Dry material is fed, by the inlets and distributor, to the center of the rotor (A). The rotor consists of two steel discs (B) spaced approximately one inch apart by specially designed impactors (C). The material is spun out, by centrifugal force, into a thinning film as it approaches the periphery of the rotor. Powerful centrifugal action causes every particle of the material to be thoroughly processed, giving complete and uniform dispersion.

square foot coverage than regular white cement, and to assure a smooth mixture, ease of application, and a hard, durable final coating.

"We have always used quality raw materials," Henry says. "But the one item that gives us an advantage over many other manufacturers of cement-based masonry paints is the way we blend our ingredients. Most of our competition uses ball mills, as we did until 1959. At that time we installed a 27-inch Entoleter centrifugal mixing machine made by Entoleter, Inc., of New Haven, Conn.

"Now we consider the Entoleter mixer an absolute necessity for proper dispersion of color and other ingredients in our dry-powder mixes. The Entoleter equipment is lighter and requires less power than ball mills. We get a final color intensity not possible before. And the mixing cycle for the Entoleter mixer is about half that of our previous equipment. This is especially true for dark colors which are very difficult to mill and bring the colors out."

The sequence of operations used by U. S. Protective Coatings to formulate its cement-based masonry paints begins with the receipt of raw materials in bags. The proper proportions of each ingredient (titanium dioxide, silicone dioxide, re-ground white portland cement, tinting materials, and others) are weighed and dumped into a mixing hopper (Figure 1.)

The mixing hopper is wheeled to the mixing station (Figure 2) and a hoist elevates the hopper into position over the ribbon blender premixer (top of Figure 2). The premixer discharge is fed into the Entoleter mixer (center of Figure 2 through a vibrating feed chute.

High-speed, high-energy centrifugal action in the Entoleter mixer (illustrated in Figure 3) breaks up any nodules or clusters of material in the mix, and produces an intimate, smooth-textured blend in which the color of the mixture has been intensified and enriched.

Dry-blended material leaving the Entoleter mixer is received in a hopper (bottom of Figure 2) which is rolled to the bagging station and elevated into position over the bagging machine (Figure 4). The product is packaged in 5-pound packages, 25-pound metal pails, 25- and 50-pound sacks ready for shipment.

Though U. S. Protective Coatings was formed recently, its products date back to the early 1920's. It was then that the Medusa Portland Cement Company of Cleveland, Ohio, established the country's first cement-based masonry paint production facility as an adjunct to its cement sales. But, in 1957, Medusa decided to concentrate its efforts on basic raw materials and sold the masonry paint division to a group of employees who formed U. S. Protective Coatings.

President R. L. Henry emphasizes that the new company has maintained the high quality standards established by Medusa—quality that has been accepted as the standard of performance by architects and engineers all over the country.

After dry-blended product leaves centrifugal mixer it is rolled in a hopper to bagging station where it is elevated into position over bagging machine for packaging in bags and pails.

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XX-600	Medium	Acicular	105
XX-620 (Densified)	Medium	Acicular	105
XX-50	Medium	Nodular	115
XX-501 (Densified)	Medium	Nodular	115
XX-2	Fine	Nodular	130
XX-55	Fine	Nodular	140
XX-601	Medium	Acicular	160
XX-621 (Densified)	Medium	Acicular	160
XX-602	Fine	Acicular	220

Fast wetting is, of course, a relative term. It should always be related to consistency. And it is so used here. Each HORSE HEAD zinc oxide in this newly improved line is fast wetting compared with conventional oxides of the same consistency.

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Minerals & Chemicals Philipp Develops Formulating System

Substantial savings in the cost of interior latex type paints may be made by using extenders in accordance with a system recently developed by Minerals & Chemicals Philipp Corp., Menlo Park, N. J. Taking into consideration the many important factors confronting the formulator, especially the top hiding power, the system inter-relates performance properties with the *cost* of pigmentation, thereby permitting the formulator to prepare paints with the properties he desires and at a cost to suit his needs.

The formulating system was developed as a result of tests conducted to determine the best performance properties with other extender combinations. It involves a series of graphs drawn to show the TiO^2 requirement of various extender blends at various predetermined PVC percentages and contrast ratios. By adjusting the three variables in his formula (PVC, Contrast Ratio, and Extender Blend) in accordance with the information revealed on the graphs, the formulator can obtain a cost and hiding power balance best suited for his purposes.

Reynolds Metals Develops Painting Technique

A technique for applying paint to aluminum which retains most of the metal's reflective luster has been developed for interior trim applications, by the Reynolds Metals Co.

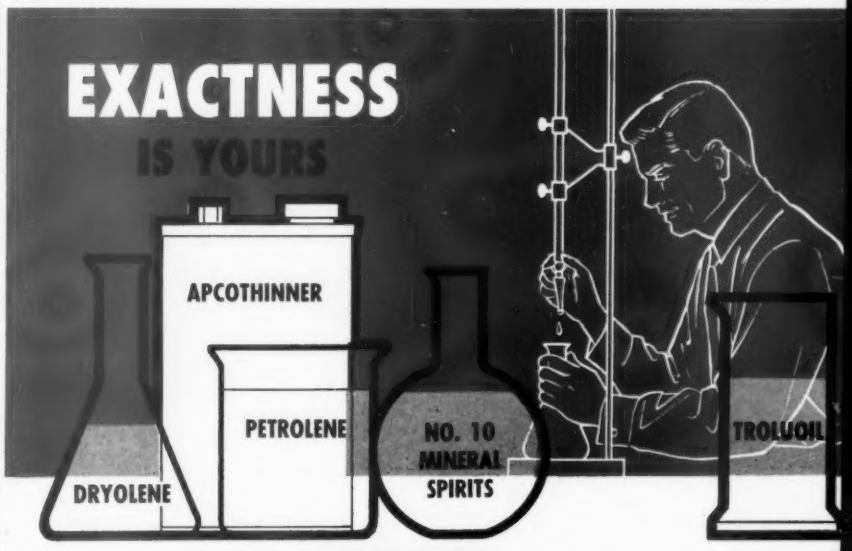
A new line of decorative trim, marketed under the name" Reflective Colorweld," now is available as a result of the technique.

This will give interior decorators a new approach to decorating kitchens and bathrooms the company said. The product, economical enough for use as wall paneling and trim around fixtures, offers unique decorating possibilities.

Reflective Colorweld is said to retain most of aluminum's natural luster. On bright sheet it has a mirror-like quality superior to color anodizing. On all other surfaces it is as bright as color color anodizing. Heretofore color anodizing has been the best technique for producing bright, colorful finishes.

"Another important advantage is that it may be formed with less danger of damaging the finish than when using anodized aluminum. It will fabricate into end products as easily as organic finishes such as Colorweld, according to the firm.

The product is offered in widths of one to 18 inches, 10 colors and three finishes—one side bright, embossed and brushed. One side bright and embossed sheet is available in a minimum gauge of .012 inches, and brushed sheet is available in a minimum gauge of .020 inches.



with APCO Solvents

Need a very fast drying lacquer solvent diluent? Try PETROLENE. A fast drying thinner for spraying enamels? Use TROLUOIL. A relatively slow drying solvent for synthetic resins? NO. 10 MINERAL SPIRITS.

In paints requiring slow initial drying and fast final drying, APCOTHINNER is the answer. But in stains where fast setting and relatively slow final dry is preferred, specify DRYOLENE, our VM&P with an I.B.P. of 200°-210°F.

For other requirements, APCO has other solvents. You can be as versatile and as precise in formulating as you want to be, when you rely on the broad line of APCO Industrial Solvents.

APCO
INDUSTRIAL SOLVENTS

WE SHIP TEST SAMPLES PROMPTLY

APCO OIL CORPORATION
OKLAHOMA CITY, OKLAHOMA

MILTON OFFERS TWO-GALLON TINPLATE PAIL

Heavy gauge lined pail makes it now possible to package water emulsion paints in the two-gallon size.

George E. Milton, Pres.

William J. Milton, Vice Pres.

FOR the first time, a two-gallon pail made of heavy gauge tinplate is now available for packaging paint. Introduced by the George A. Milton Can Company, this new type of pail is said to offer several new plus features.

Among these are a 2-gallon pail lined with the same coating used on the inside of one-gallon cans and smaller. This feature makes it now possible to package water emulsion paints in the 2-gallon size, economically.

With the aid of special machinery, the new 2-gallon pail can be lithographed in a variety of colors for promotional and advertising effect.

One big advantage of tinplate pails is that for shipping purposes they are packed in paper bags (18 pails in a bag). This provides the paint manufacturer the same ease in handling and storing as the smaller size cans.

According to the manufacturer, these 2-gallon tin plate pails are expected to cost less than conventional types because tin plate cans lend themselves to automatic processing methods. A lower cost pail will be reflected in cost savings to paint firms whose business with paint contractors is mostly in large size units.

The design of the new tin plate pail is such that there is a minimum amount of "headspace"—reducing the possibility of skinning of oleo-resinous-based paints.

For further details, contact the George A. Milton Can Co., Inc., 131 North 14th St., Brooklyn 11, New York.

Special machinery is used to fabricate the tinplate two-gallon container.

Fast-curing resin with good stability

Though Rohm & Haas UFORMITE® MM-55 melamine formaldehyde resin cures very quickly at moderate baking temperatures, baking enamels formulated with it have excellent stability.

UFORMITE MM-55 provides hardness, mar-resistance, good gloss, and chemical resistance to enamels used in finishing refrigerators, washing machines, stoves, kitchen cabinets, hospital equipment, and similar items. Color retention is outstanding on heat-generating appliances such as ironers. In pigmented air-drying nitrocellulose lacquers, a small proportion of UFORMITE MM-55 will retard chalking and aid gloss retention.

Many other UFORMITE melamine resins are also available, offering a wide range of useful formulating characteristics. Test data and formulating information will be sent on request.

ROHM & HAAS
PHILADELPHIA 5, PA.

UFORMITE MM-55

Now you can greatly increase warehouse space* at no increase in cost with...

AZODOX high apparent density zinc oxides

You can store AZODOX in much less warehouse space than required by other zinc oxides. Reason is, you get many more pounds of AZODOX per cubic foot of pigment, up to 65 lbs./cu. ft.! And smaller bags handle easier, faster—stack higher safely—reduce breakage losses—are shaped to give close-packed, unitized shipments.

In the manufacture of AZODOX, an exclusive process removes excess, space-wasting air from between individual particles of zinc oxide. That's all! Actual pigment density and all other desirable properties are unchanged. In comparison with other zinc oxides, high apparent density AZODOX flows freely yet dusts less, increases mixing capacity, disperses readily.

You can get high apparent density AZODOX in five grades of AZO brand lead-free paint pigments: acicular or nodular particle shape. For technical data, just fill in and mail this coupon.

*Pallet load of AZODOX on left above is 30.4 cu. ft. Pallet load of regular zinc oxide on right is 44 cu. ft. Same number of bags; same weight . . . *but a 30 percent saving in space!*

AMERICAN ZINC SALES COMPANY
1515 Paul Brown Bldg., St. Louis 1, Mo.

Please send me technical information about . . .

- ☐ AZODOX high apparent density zinc oxides
- ☐ 15 types of AZO brand zinc oxides

Name.....Title.....

Company.....

Address.....

City.....Zone.....State.....

American Zinc sales company

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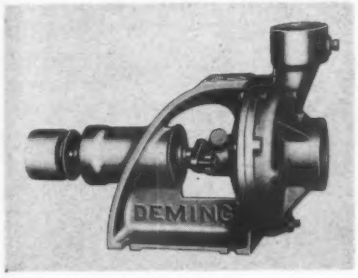
NEW EQUIPMENT AND MATERIALS

This section is intended to keep our readers informed of new materials and equipment. While every effort is made to include only reputable products, their presence here does not constitute an official endorsement.



DEMING

CENTRIFUGAL PUMP
Double Ball Bearings

New two-ball bearing end suction centrifugal pump is announced.

The new pump employs double ball bearings and is equally suited for belt or direct motor drive. Capacity range is from 10 gpm to 300 gpm, and heads range to 150 feet. Semi-open impeller is mounted on stainless shaft with precision taper fit for perfect alignment and easy removal.

"Back-pull-out" feature enables pulling working parts without disconnecting casing from piping.

Stuffing box and split gland are standard, but mechanical seal is available at no extra cost. Seal is recommended for temperatures up to 180° when handling non-abrasive fluids.

A 4-inch combination pulley (suitable for flt or V-belt) is available when ordered.

Pump is suitable for booster operation when suction pressure does not exceed 25 lbs. Normally furnished for right-hand operation, but left-hand available in all but 3" size.

The Deming Co., Dept. PVP, Salem, Ohio.

FERROUS TRAP & FILTER
Permanent Tube Magnet

Combined ferrous trap and filter for installation on lines carrying various liquids or slurries has been developed. Screen trap removes both iron contamination and non-magnetic particles in one compact unit. The trap is quickly removed for easy cleaning.

Heart of the new trap is a one-inch stainless steel permanent tube magnet enclosed in a two-inch diameter perforated bronze filter screen with either .020 or .033-inch diameter holes. Magnet and filter are

ERIEZ

enclosed in a 350-pound pressure bonze casting which has a standard two-inch pip thread inlet and outlet. Use of adapter connections adapts the trap for use on lines of various sizes.

The trap's design permits material to be passed over the magnet first and then through the filter, or vice versa.

Eriez Mfg. Co., Dept. PVP, Erie, Pa.

CURING AGENT
For Solventless Coatings

New and improved curing agent for solventless coating systems is now available. In combination with low viscosity epoxy resins, (e.g. Araldite 502), the new curing agent, Araldite DP-121A produces coating systems that can be applied in single-coat, dry-film thicknesses of 5-10 mils. DP-121A epoxy systems have longer pot lives than previous solventless epoxy systems, it is claimed.

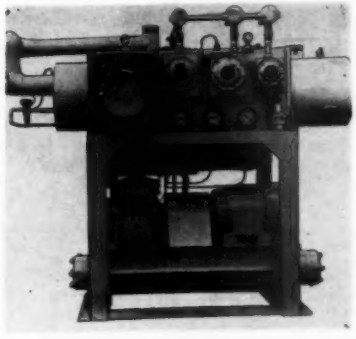
Finishes produced from these systems cure at room temperatures to hard, tough, flexible films, high in gloss and possessing good chemical resistance. In addition, since no solvents are present, fire hazards are minimized.

Flow control agents are deemed unnecessary in conjunction with Araldite DP-121A. Systems using the new curing agent exhibit improved levelling and gloss, eliminating pigment flocculation problems.

CIBA Products Corp., Dept. PVP, Fair Lawn, N. J.

LIQUID CHILLER UNIT
Self-Contained

Custom built and explosion proof, liquid chiller unit is self-contained and pre-assembled. It is furnished in three ton through one-hundred and fifty ton sizes for chilling water or other liquids where equipment is



KOCH

located in hazardous areas. Unit is offered in air or water cooled condenser models; it is equipped

with a pre-wired control center containing all operating controls and protective devices.

All refrigeration piping and piping insulation is supplied. To place equipment in operation it is necessary only to connect electrical power to the control center and connect fluid lines to the chiller.

Control of fluid temperatures is precise, making the explosion-proof chillers ideal for processing in the food, chemicals, plastics, oil refining, nuclear, and paint industries.

George Koch Sons, Inc., Thermal Div., Dept. PVP, 2112 Pennsylvania Expressway, Evansville 4, Ind.

DISPENSING RACK
Baked Enamel

An improved dispensing rack features a new tiered rack which is all metal and is factory finished in baked enamel.

The twelve canister rack requires 3.9 square feet of display area.

Autoblend Products Co., Dept. PVP, 444 Market St., San Francisco 11, Calif.

LEVEL CONTROL
Direct Mounting

A fully self-contained capacitance probe-type material level control for direct mounting on bins, hoppers, tanks or other containers holding dry, semi-dry or liquid materials has been developed.

Model L201 level control is provided in both high-level and low-level units. Probe is integral with the explosion-proof control casing. Entire instrument is mounted as one unit at the point of control desired.

Because of its high sensitivity range the level is recommended for use with such light weight, low capacitance materials as plastic powders or pellets. It also has a wide range of level control applications for powdered or granular materials, semi-liquids and liquids.

Presence or absence of material is detected by the probe through changes occuring in the electrostatic field. A signal is given to the control circuit which activates a 2-way fail-safe snap action relay to effect operation of the filling or shut-off device.

Simple modular design of the control assembly assures dependable operation, easy servicing. Self-contained feature of the instrument eliminates extra cost and labor of installing cables between sensing device and a remote control box.

A threaded hub on the control permits mounting at any point desired simply by screwing the entire probe and control assembly into a standard pipe coupling attached to the wall of the container.

Electronic Controls Div., Flo-Tronics, Inc., Dept. PVP, 712 West Ontario St., Minneapolis, Minn.

COLORANT DISPENSER
Durable, Accurate

Colorant dispenser has been designed to serve the needs of the smaller volume paint dealer. Like the higher priced units in the firm's "100" and "200" series, the new series is said to be durable, accurate, practically trouble free. With its canisters containing one and one-half quarts of colorant, as compared to two and one-half in the "100" DeLuxe and the "200" standard models, it occupies a minimum amount of store space.

H. G. Fischer & Co., Dept. PVP, 9451-9491 W. Belmont Ave., Franklin Park, Ill.

Buy all your Aliphatic, Intermediate and Aromatic solvents at one place... at one time! Get these benefits!

- **"Packaged" Delivery Tailored to Your Needs** — Orders for small lots can be combined into a single compartment-lot shipment. Reduces purchasing agents' work, simplifies unloading and handling and insures all products arriving at one time, minimizing production delays.
- **Reduced Freight Costs** — Compartment-lot shipments of smaller, multi-product orders by tank car, transport truck, barge or ship enjoy bulk rates.
- **Lower Inventory Investment** — Now only minimum stocks need be kept on hand — frees capital tied up in unnecessary inventory. Losses from evaporation and other causes greatly reduced. Fresh stock insured at all times.
- **Immediate Delivery** — Signal's nation-wide network of conveniently located terminals insure quick delivery to all points.

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SIGNAL OIL AND GAS COMPANY
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Cleveland Office: 20800 Center Ridge Rd., Cleveland, Ohio, Phone EDison 3-0188
Louisville Office: 4th and Broadway St., Louisville, Ky., Phone JUniper 3-7634
Atlanta Office: 3121 Maple Drive., N.E., Phone CEdar 3-3227
Long Beach Office: 2828 Junipero Ave., Long Beach, Phone NEvada 6-3301

NEW MATERIALS — EQUIPMENT

DIMER ACID
Good Color Stability

Introduction of a new, lighter-colored commercial grade of dimer acid has been announced.

The product, designated Empol 1018, features an 8 max. Gardner color, compared to an 11 max. for the standard commercial grade, Empol 1022. It also has excellent color stability, typically 8+ Gardner after 2 hours at 205°C. in an open test tube.

Empol 1018 has a typical composition of 83% dimer acid, a C_{36} aliphatic dibasic acid, and 17% trimer acid, a C_{54} tribasic acid. Monobasic acids are specified at less than 1%, and typically are found present only in trace amounts. Although basically a light-colored, low-monobasic version of Empol 1022, Empol 1018 also contains a slightly lower amount of trimer acid, which may affect the cross-linking, viscosity, and gellation properties of its derivatives.

The combination of lighter color, strong color stability, and low monobasic acid content make Empol 1018 an excellent dibasic acid for polyesters, polyamides, esters, ester-based urethanes, varnishes, epoxy ester coatings and any other use in which the lightest possible color is desired.

The long-chain dimer structure imparts an increased degree of flexibility to its derivatives. The trimer acid present in Empol 1018 permits cross-linking, increasing the derivatives' toughness. The use of dimer acid in surface coatings also improves caustic resistance.

Emery Industries, Inc., Organic Chemicals Div., Dept. PVP-5, Carew Tower, Cincinnatti 2, Ohio.

UNIVERSAL TONERS
No Odor

A new line of universal toners has been introduced.

Embodying the latest scientific advances in color manufacture, the new, high quality tinting colors boast maximum versatility. They are effective in a wide variety of paint finishes, including oil base and alkyd flats, satin gloss and gloss enamels, house paints, latex, P.V.A. acrylic and other resin emulsion paints—for interior use and, in most cases, exterior use, as well.

The 13 base colorants in the line are made with quality pigments finely ground to provide quick dispersion and smooth texture, without settling or skinning. They possess superior tinting strength and produce an unlimited array of colors. In addition, they have no offensive odor.

Included in the "Magic 13" universal toners is purple, a color which is becoming highly popular in interior decorating and which has not been widely available as a colorant.

The most popular colorants will be available in gallon sizes, as well as quarts and half-pints. Handsome color cards sampling masstones and let-downs have been prepared.

The toner line is comprised of raw umber, chrome oxide green, burnt umber, burnt sienna, permanent phthalo green, hansa yellow, raw sienna, lamp black, purple, red oxide, bright red, permanent phthalo blue and handa orange.

Martin-Senour Co., Dept. PVP, 2500 S. Senour Ave., Chicago, Ill.

CAN DISPERSION MIXERS
Simplified Lowering

New double planetary changeable can mixer in 8, 12, and 20 gallon sizes with dispersion type stirrers and simplified hydraulic

EXTERIOR LATEX
WOOD
MASONRY

weather best with ASP extender
ALUMINUM SILICATE PIGMENTS

In recent tests of leading paint extenders in various latex emulsions, ASP 400 gave the best all-round weathering performance . . .

on wood . . . staining and water spotting were negligible; chalking, fading, and dirt collection were less; film life was longer . . . after 22 months of exposure.

on masonry . . . mottling, micro-cracking, efflorescence, and color loss were less regardless of surface texture . . . after 500 hours in a Weather-Ometer.

In two-year tests, paints containing ASP 400 settled less and changed viscosity less than other extenders, in paints based upon 5 different kinds of latex.

The tests, made with white and colored paints, were arranged so that an accurate check of each latex was possible, and comparisons were obtained with a high degree of certainty. For a full story on the test, send the coupon below. For recommendations on the use of ASP extenders in specific latex systems, ask our research staff. They will be glad to discuss formulations which will provide the most desirable paint properties.

MINERALS & CHEMICALS PHILIPP CORPORATION
1221 Essex Turnpike, Menlo Park, New Jersey

Please send:
☐ TI-209B (wood) ☐ TI-212 (masonry) ☐ Sample of ASP 400

Name ..... Title .....
Company .....
Address .....
City ..... Zone ..... State .....

MINERALS & CHEMICALS PHILIPP

lowering and raising device has been announced.

These new mixers are part of the firm's line of double planetary mixers which are available from one Quart to 150 gal. sizes. The new machines feature a compact built-in hydraulic control for raising and lowering stirrers from can. With stirrers tilted back out of can for cleaning or removal of can the floor mounted mixers are extremely compact and low in overall height.

Stirrers are of one-piece cast steel or stainless steel construction and overlap center of can as well as each other. Stirrers rub close to each other and can sides to develop a tremendous compressive and shearing action on the heaviest paste materials. The double planetary mixing action produces results previously only obtainable in double arm kneading machines.

Standard units are provided with variable speed motor drive, and vacuum covers or jacketed cans are among the optional features.

Charles Ross & Son Co., Dept. PVP, 145-156 Clusion Ave., Brooklyn 5, N. Y.

TANTALUM LINED REACTOR
Externally Agitated

Tantalum lined pendaclave. Operates at pressures to 5,000 p.s.i.g. at 300°C. and has a capacity of 300 ml.

The pendaclave is an externally agitated reactor which, because of its unique design, provides 2-3 times greater gas to liquid contact than conventional agitation systems. The reactor is supported within its heating jacket at the end of a pendulum arm. The motion imparted to the gas and liquid in the reactor approaches rectilinear.

Ease of adaptation of agitation conditions to meet a wide variety of requirements is assured by the fact that The length of the stroke can be 6, 8 or 10 inches and the speed can be varied.

The tantalum lined pendaclave is provided with a thermowell, high pressure inlet and large rupture assembly connected to a high pressure flexible vent hose. Either vapor or electrical heating is available. A special safety feature is that the electrical heating jacket can be purged with inert gas.

Pressure Products Industries, Inc., Dept. PVP, Hatboro, Pa.

VIBRATING FEEDER-HOPPER
Prohibits Contamination

New feeder-hopper combination for moving bulk granulars and powders without contamination or causing dust has been announced. Completely enclosed, this feeder-hopper is powered by air.

Designed for accurate, close control of material flow, the Model 24S3-125 is two feet long with a 1½ cubic foot hopper. Aluminum or stainless steel models protect food products, chemicals or any material which must be kept free from contamination. The smooth conveying surface resists abrasion and can be cleaned with common cleaning agents. There are no moving parts to come in contact with the material being handled.

The metal hopper located above the feeder can be attached with a dust-tight flexible boot. Compact supporting structure saves space and eliminates additional mounting when the feeder-hopper is installed.

An air-powered vibratory drive unit mounted under the feeder supplies the force to move up to 6000 lbs. of granulars per hour. Completely enclosed, this feeder will operate while submerged in a

Independent Laboratory* confirms "...Tung Oil, in exterior Latex Paints, produces superior adhesion on chalky painted wood and masonry surfaces".

NOW YOU CAN
SOLVE ADHESION PROBLEMS
IN EXTERIOR LATEX PAINTS
WITH RAW TUNG OIL!

You can **insure** superior adhesion on difficult chalky painted wood and masonry surfaces, when you add raw TUNG OIL to Exterior Latex Paints. And the same Research Report, issued by a leading Independent Laboratory*, **confirms the superiority of raw TUNG OIL in obtaining adhesion without sacrificing other important performance qualities.**

*DAVID LITTER LABORATORIES—New York, N. Y.

For your copy of this Significant Research Data, write:

NATIONAL TUNG OIL MARKETING COOPERATIVE, INC.
205 Cumberland Street • Poplarville, Mississippi
Exclusive Sales Agents: PACIFIC VEGETABLE OIL CORP.
1145 South Tenth Street • Richmond, California

liquid. Automatic lubrication of its one moving part reduces maintenance.

The Cleveland Vibrator, Dept. PVP, 2828 Clinton Ave., Cleveland 13, Ohio.

PHTHALO BLUE DISPERSION
Broad Compatability

New phthalo blue dispersion which eliminates troublesome variations in blue latex paint production has been developed. Designated "Aurasperse W-4123," this new pigment features unusually broad compatibility—a highly desirable characteristic which has been missing in the products heretofore available. W-4123 incorporates also the qualities of good dispersion, stability and bright clear color values, making it especially well suited for blending with other colors. It may be used with excellent results in either inside or outside surface coatings. This new phthalo blue dispersion is moderately priced, and available now in production quantities.

The Harshaw Chemical Co., Dept. PVP, 1945 E. 97th St., Cleveland 6, Ohio.

AUTOMATIC TITRATOR
Automatic Stirrer

New automatic laboratory titrator has just been introduced. Named the "Titrion," this titrator quickly, precisely and automatically performs any titration in which the end point can be related to a reproducible electrode potential, including pH, redox and conductometric procedures.

The titrator is designed for high speed and accuracy—it provides titrations to accuracies within ± 0.1 pH with elapsed time of only 1 to $1\frac{1}{2}$ minutes; and with an actuation potential sensitivity of only 2 millivolts.

Automatic features include electronic sensing of the end point, and progressive restriction of the titrant flow as the end point is approached. The instrument has operating and cycle completion signal lights as well as automatically-controlled magnetic stirring.

Coleman Instruments, Inc., Dept. PVP, 42 Madison St., Maywood, Ill.

• *Sherwin-Williams uses*

COLOR-EYE

in 3 different phases of their operation

RESEARCH and DEVELOPMENT

"COLOR-EYE is used in the selection of the most efficient color pigment combination for a given formulation and to obtain a spectral match for a color of unknown composition. It is also used to check and read the color stability of pigment combinations of proposed formulations."

PRODUCTION

"Our shaders find the use of instruments helpful in getting their batches within the tolerance set by our Quality Control Laboratories. By the use of instrumentation COLOR-EYE in place of the old fashion hit and miss method, they are able to shade more effectively and faster, which results in an increased tank turnover."

QUALITY CONTROL LABORATORIES

"We check production to be sure the color falls within a predetermined tolerance. It is important with multi-plant operations that our tolerance for a given line be the same from plant to plant, and this can only be done by the use of instrumentation (COLOR-EYE). Our production is again checked within thirty days to be sure it is still up to standard for color."

COLOR-EYE is a colorimeter and abridged spectrophotometer, combined in a single, compact sturdy instrument. It is simple to operate and is considerably more sensitive to color differences than the human eye, especially in dark colors with reflectance of 30% or less.

COLOR-EYE is in use in hundreds of plants and dozens of industries which are served by IDL sales and engineering offices located in major industrial areas. For further information, write for complete brochure Model D COLOR-EYE.

IDL

INSTRUMENT DEVELOPMENT LABORATORIES, INC.
Subsidiary of Royal McBee Corporation
67 MECHANIC STREET, ATTLEBORO, MASSACHUSETTS, U. S. A.

PATENTS

Complete copies of any patents or trade-mark registration reported below may be obtained by sending 50c for each copy desired (to foreign countries $1.00 per copy) to the publisher.

Pipe Enamel

U. S. Patent 2,973,280. Arnold J. Hoiberg, Morristown, N. J., and Charles E. Cowger, El Dorado, Ark., assignors to Monsanto Chemical Company, St. Louis, Mo., a Corp. of Dela.

An improved asphaltic protective coating composition having incorporated therein from 17% to 25% by weight of an inert mineral filler of a fineness permitting 90% of the filler to pass through a 325 mesh screen characterized by a maximum viscosity of 1,000 seconds (Saybolt Furol) at 375° F., a flash point of at least 125° F. above the temperature at which the coating composition has a viscosity of 1,000 seconds (Saybolt Furol), a maximum penetration at 150° F. (50 g., 5 secs.) of 45, a maximum settlement ratio at 450°F. of 1.3, a water absorption of less than 1.0% after 35 weeks' immersions of a 90-100 mil film, a stain index of less than 15, a maximum sag of 1/16" at 160° F. after 24 hours, no cracking and disbonding at . . 20° F., no visible cracking under bend test at 77° F., no cracking under impact test at 32° F., a maximum of 9 mils penetration at 85° F. for 100 hours as determined by rod deformation test, an initial electrical resistivity of at least 1×10^{15} ohm-cm. and an electrical resistivity greater than 1×10^{12} ohm-cm. after 35 weeks' immersion on a film of said composition in water.

Coating Compositions

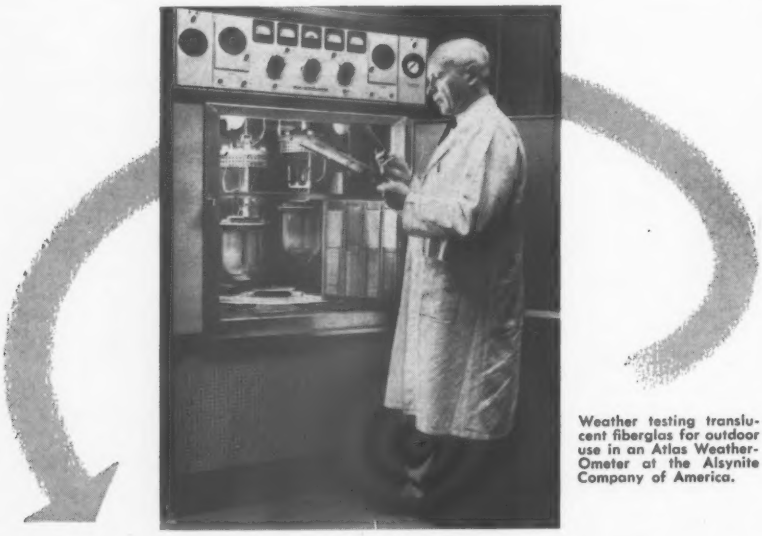
U. S. Patent 2,970,927. Bernard David, 1434 Dairy Road, Charlottesville, Va.

A composition for protectively coatnig metallic surfaces against the effects of high temperature consisting essentially of a homogeneous suspension in a liquid vehicle of colloidal graphite and at least one colloidal metal of low activity, said metal being selected from the group consisting of silver, gold and platinum, said liquid vehicle being selected from the group consisting of non-drying vegetable oils and mineral oils, wherein is contained between about 7.5 and 8 parts of graphite for each part of said metal.

Apparatus For Coloring Paint

U. S. Patent 2,972,435. Daniel R. McCarty, Santa Cruz, Calif., assignor to Universal Color Corp., Oakland, Calif., a Corp. of Calif.

In paint compounding where a base paint is to be tinted with one or more different paint colorants, the combination comprising a container for liquid paint colorant, a volumetric measuring device, said device comprising a longitudinally extending cylinder having a pipe connected to one end portion thereof and extending into said container for supplying the liquid colorant to said cylinder, a piston in said cylinder, means for moving said piston to the other end portion of said cylinder for sucking the colorant into said cylinder, said last mentioned means also moving said piston from said other end portion to expel colorant from said cylinder, and means for controlling the movement of said piston from said other end whereby the colorant expelled from said cylinder is always taken from said cylinder full of colorant, said last mentioned means including adjustable means whereby the colorant is expelled in various quantities differing from each other only by a few drops and ranging from a few drops thereof to substantially the whole contents of said cylinder, said last mentioned means comprising a plate with a plurality of rows of pin receiving holes formed therein, said rows of holes extending across said plate at angles such that each of the holes in a row is longitudinally displaced from an adjacent hole by an equal distance and also such that the last hole of one row is longitudinally displaced from the first hole of the next row by the aforesaid same distance, and a pin adapted to be positioned in any one of said holes for limiting the movement of said piston so that the quantity of colorant designated by the hole may be expelled from said cylinder.



Weather testing translucent fiberglas for outdoor use in an Atlas Weather-Ometer at the Alsynite Company of America.

Weathering Qualities of Paints
can be pre-determined with speed and accuracy in the
WEATHER-OMETER®

The natural weathering effect of sunlight, moisture, thermal shock and rain is reproduced on a highly accelerated basis in the Weather-Ometer. The cycle to be used is controlled by the Cycle Meter which automatically regulates the length of the exposure to light and moisture under controlled conditions of temperature. Available with automatic control of relative humidity permitting exposures under conditions simulating the formation of dew.

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To achieve such proven performance records, CIBA chemists and technicians work closely with paint manufacturers to arrive at epoxy formulations with optimum qualities. Everywhere that paint is used to fight corrosion in industry today, top performance results testify to the superiority of epoxy coatings over conventional materials.

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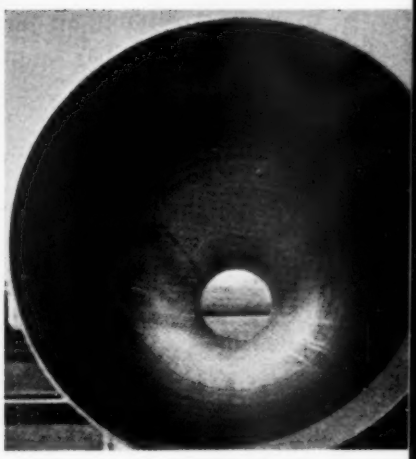

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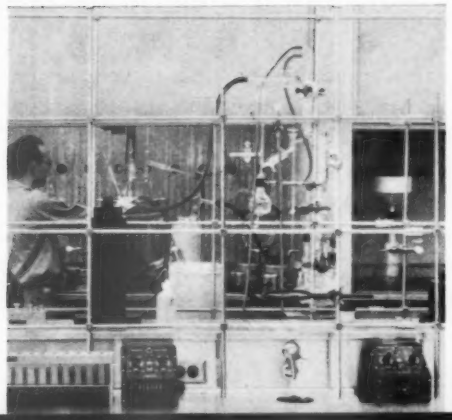

C I B A

TECHNICAL Bulletins

SILICONES

Extreme heat protection, low temperature flexibility, good electrical properties, resistance to ozone, corona, weathering and thermal shock are just a few of the properties that are enabling silicones to play such a vital role in meeting today's space age requirements. A complete discussion of these properties as they relate to silicone applications for the aerospace industry is now available in a new 16-page brochure, designed as a reference guide to silicones.

Entitled "Silicones for the Space Age," the attractive two-color brochure is abundantly illustrated with photos and charts to enable the user to quickly decide what silicone compound will fit his application. Also included is comparative data pertaining to silicones and other compounds as high temperature insulating materials.

The publication discusses silicone rubber for insulation and fabricated parts; RTV liquid silicone rubber as a potting and encapsulating compound; silicone varnishes for high temperature dipping and impregnating and thermal and dielectric coatings; clear, self-supporting silicone potting and embedding compounds for protection of electronic parts and assemblies; and silicone dielectric fluids and coolants for heat transfer and size reduction. Also covered are silicone dielectric and lubricating greases, silicone high temperature paint additives and masonry water repellents. A section of the brochure is also devoted to testing facilities available for offering complete product and application assistance.

Silicone Products Dept., General Electric Co., Dept. PVP, Waterford, N. Y.

VINYL SOLUTION COATINGS

A "how-to" booklet on vinyl solution coating formulation techniques provides the coatings formulator with valuable basic information on the general properties and uses, formulations and preparation of clear, as well as pigmented coatings, and application methods. Also, included are two particularly useful tables listing the pigments and dyes suitable for tinting vinyl finishes. Completely illustrated, this booklet shows applications ranging from sulphuric acid processing equipment to vinyl-coated book binding.

Union Carbide Plastics Co., Dept. PVP, 270 Park Ave., New York 17, N. Y.

CHROMATOGRAPH

New gas chromatograph is described in a brochure which has just been published.

A detection system of the thermal conductivity filament type—with a fast response full-flow cell geometry, and with a sensitivity 10 to 20 times greater than most filament-type detectors—is employed by the new instrument. The detection system makes the instrument extremely valuable for trace analyses, even with very small samples such as those used in fast analyses.

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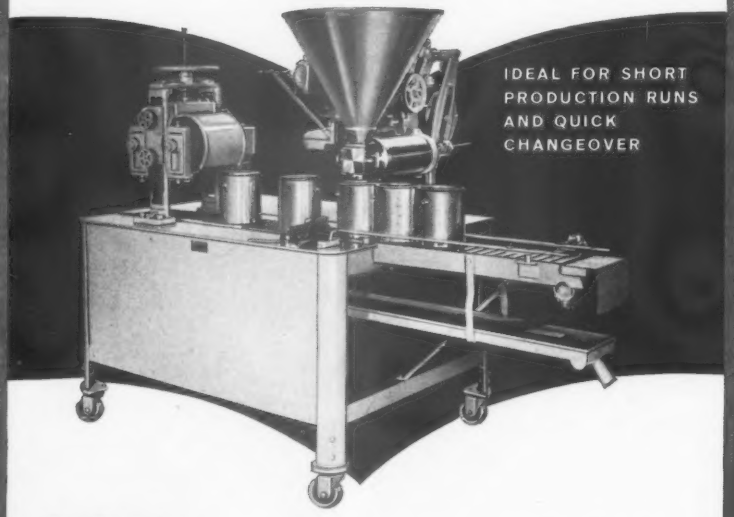

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Beckman Scientific and Process Instruments Div., Dept. PVP, Fullerton, Calif.

MIXERS

The complete line of the firm's mixers is the subject of an 8-page bulletin just published.

"Cincinnatus" mixers—light, medium and heavy duty—are double arm mixers designed for the processing of viscous fluids and semi-solids. Detailed information on construction features and available types of agitators is given in this 8-page bulletin. These mixers are built in tilting types, ranging from 5 gallon to 200 gallon working capacities, and in non-tilting types ranging in working capacities from 20 to 1000 gallons.

The J. H. Day Co., Dept. PVP, 4932 Beech St., Cincinnati 12, Ohio.

PLATY PIGMENTS

Part I of "Comparative Studies on Different Platy Pigments in Alkyd Paints Using Platy Pigments in Connection with Other Pigments" is the subject of a technical bulletin which compares the effect of different platy extenders in paints which have a rutile titanium dioxide as the hiding pigment and a magnesium silicate as a fibrous extender. The platy extenders used are mica, aluminum and stainless steel flakes. The tests show particularly interesting results for wet ground mica which, as a component in higher reflecting paints, maintains its reflectance to a higher degree and, in mixture with a metal pigment, increases the sealing properties due to a higher pigment particle distribution.

Wet Ground Mica Assn., Inc., Dept. PVP, 420 Lexington Ave., New York 17, N. Y.

PIGMENT EXTENDER

New pigment extender is described in a technical bulletin now available. Called "Micro-Cel T-38," the synthetic, hydrous calcium silicate displays remarkable hiding power at low concentration, according to the literature.

Described are ways in which the silicate can effect savings for manufacturers of emulsion paints in either of two ways. Data included show that from 30 to 35 pounds of

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T-38 can replace 40 to 50 pounds of titanium dioxide per 100 gallons with no loss of opacity, giving a saving of approximately $10.00 per 100 gallons. In existing formulae, more hiding power can be achieved by using moderate amounts of the silicate instead of adding titanium dioxide. In this latter case, significantly additional hiding power is obtained at a moderate cost, much less than if titanium dioxide has been used. The bulletin contains other data on suggested formulations for achieving such savings.

Johns-Manville, Celite Div., Dept. PVP, 22 E. 40th St., New York 16, N. Y.

COLOR TRENDS

Ninth edition of the Colortrend Report showing the changes that have taken place in color preferences in the paint industry during the past twelve months has been published.

The report shows actual swatches of 56 colors, including the top five sellers in each major color family. Graphs indicate the sales performance of specific colors over the past five years.

The company says it has formed a new activity to gather, collate and co-ordinate a broadened range of color trend data, with specific emphasis on those colors currently achieving greatest popularity in the trend-setting home furnishings field. As a supplement to the report, the firm offers color standards for 24 "Forecaster Colors" of major home furnishings importance.

The report shows the greatest gains in the lighter beiges—especially those towards the peach tones—lighter blues, lavenders and off-whites. On the downward side are greens, grays, yellows and taupes. Aquas and the creamier pastel pinks remain very strong.

California Ink Co., Dept. PVP, 545 Sansome St., San Francisco, Calif.

LIQUID BLENDING

"Vari-Flo" proportioners and new concepts in continuous line blending are detailed in Bulletin 650, just released.

According to the bulletin, the firm employs the flow control principle of their Vari-Flo variable volume pumps to develop complete proportioning systems which offer substantial savings over alternate blending methods. The new equipment is designed for applications involving total flow rates between one and 2000 gallons per minute.

Simplicity of design and operation and lower initial costs are said to be the chief advantages over other line blending equipment now available. Additional savings in piping, tanks, processing time and other factors are claimed where batch or tank blending methods are replaced. The bulletin points out that this combination of savings often makes Vari-Flo systems practical in many processes where line blending was once considered too expensive or complicated.

Following a general discussion of the advantages of line blending, the bulletin makes ample use of illustrations to explain the operating principle of the Vari-Flo units, which form the primary components of each proportioning system. An elaborate schematic layout is used to describe the purpose and function of various secondary components from which packaged systems are engineered.

Also included is a series of brief factual reports from typical users documenting the accuracy and economies claimed for Vari-Flo line blending. These on-the-job case histories are complete with pictures and detailed diagrams of each installation. The bulletin closes with an outline of basic information required by the firm's engineers to quote on a given application.

Blackmer Pump Co., Dept. PVP, Grand Rapids, Mich.

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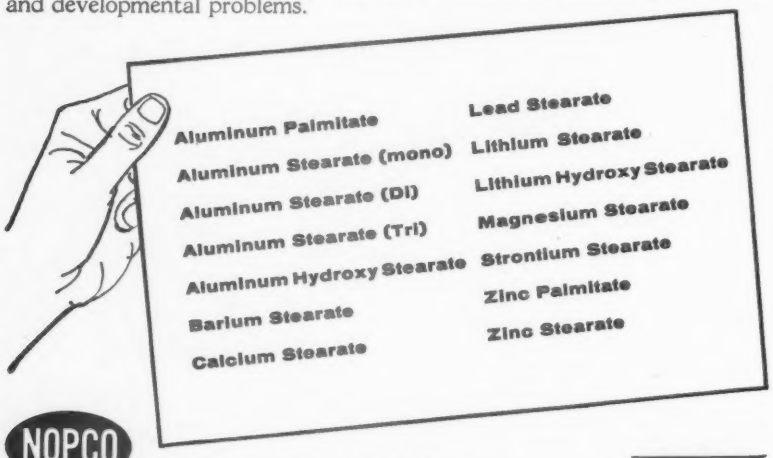

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LAKOKRASOCHNYE MATERIALY I IKH PRIMENENIE

A Study of the Styrene-Divinyl-Methylvinylpyridine Copolymer as Film-Forming Agent for Water-Emulsion Paints.

I. S. Okhrimenko and V. S. Shibalovich. Lakokrasochnye Materialy i Ikh Primenenie, 5:8-11 (October 1960.)

The three-component copolymer of styrene, divindyl and 2-methyl-5-vinylpyridine (70:20:10) may be employed as basis for a new type of oil-free, water-soluble paints, capable of forming steric structures without heating. The following grafting agents were tested: chloranil, 1,3 - dinitro - 4,6 - difluoro - benzene, oxalic, citric, phosphoric acids, and some other reagents; in room conditions, orthophosphoric acid proved to be the most satisfactory grafting agent. Of the plasticizers tested, dibutylphthalate (in ratio of 15 parts by weight to 100 parts by weight of dry polymer) is suggested; phenolformaldehyde resin was taken as modifier. Some conclusions are offered concerning the structure of the conversion products, together with possible explanations of the causes of the observed reversibility of steric polymerization.

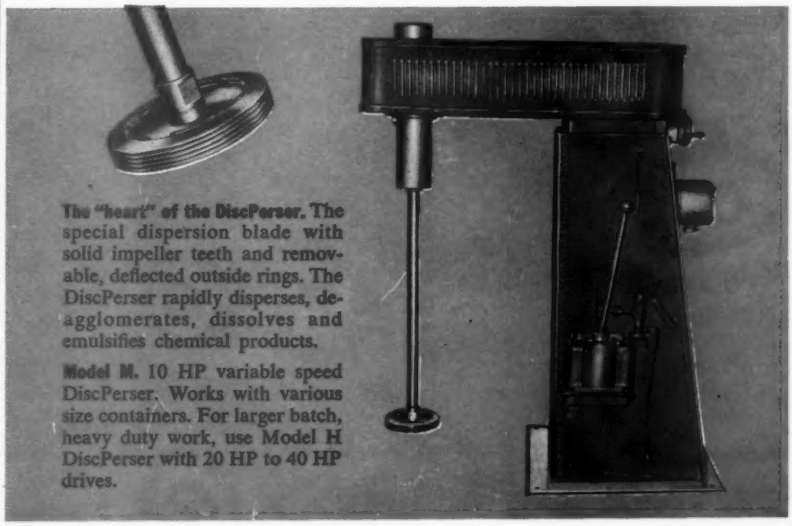
The styrene - divinyl - methylvinylpyridine latex may also be employed as the film-forming agent in preparation of pigmented paints designed for use on plaster and metallic surfaces; in the former case, lithopone was taken as the pigment, in the latter, iron minium. Tabulated comparisons of the corrosive characteristics of the paint shows that the latex paints on basis of the tested copolymer, modified with phenol-formaldehyde resin, surpass pentaphthalic enamel (No. 65) as to these properties: vapor permeability, stability to water, impact resistance, and anti-corrosive characteristics.

Synthetic Resins from Arylglycide Esters. Communication I: Synthesis of Resins from Arylglycide Esters and Substituted Aromatic Amines.

M. F. Sorokin, K. A. Lyalyushko, and R. A. Dudakova. Lakokrasochnye Materialy i Ikh Primenenie, 5:1-7, (October 1960).

The studied bimolecular reaction of N-alkylamines with arylglycide esters may be described by a second-order equation. The studied arylglycide esters (phenyl; *p-tert*-butylphenol; and exo-(dimethylphenyl)-*p*-cresol) do not differ as to reactivity. The reaction rate is influenced by the dissociation constant of the amine, the molecular weight of the substituted alkyl, and by the introduction of a methyl group into the aromatic ring (the latter two factors tend to decrease the reaction rate).

The authors synthesized new epoxy-amine lacquer resins; the basic reaction in the formation of the resin is that between epoxy and amino groups (no reaction takes place between epoxy and hydroxyl groups). The synthesis in bloc proceeded by taking the following moledular ratios of diglycide ester to N,N'-dialkylamine: 1:1, 1.5:1, 2:1. The amount of diglycide group in the finished product increases with the higher content of diglycide ester in the starting mixture; the molar ratios of the starting mixture also affect the molecular weight of the resin. The temperature of synthesis has an insignificant effect on both molecular weight and dispersivity of the resin. The resins are well soluble in acetone, acetates, ethyl cellulose, dioxane, carbon tetrachloride, chloroform, and in



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mixtures (1:1, by weight) of butyl alcohol with xylene, and of acetone with tolune. They are stable and withstand storage of over one year in good condition.

The authors also tested lacquer films prepared from 40-50% solution of the resin in a mixture (1:1) of butyl alcohol and xylene; using hexamethylenediamine, the film solidfies and is dried at 80°C. (films dried at room temperature have poor physico-mechanical properties). Lacquer films prepared in such a way have good physico-mechanical properties, if the initial-mixture ratio of diglycide ester to amine is 2:1 or 1.5:1, and may be used for preparation of lacquer coatings. In a thermostat at 200°C., the film begins to darken after eight hours of heating.

Atmospheric Coatings from Copolymers of Vinylchloride and Vinylacetate.

A. K. Muromtsev and I. P. Shabodalov. Lakokrasochnye Materialy i Ikh Primenenie, 5:18-21 (October 1960).

In contrast to numerous coating products from the copolymers of vinylchloride and vinylacetate manufactured in the United States (*cf.*: Cook, *Paint & Varnish Production, 43,* Nos. 1, 2, 3 (1953), the Soviet Union produces two copolymers: A-15 and A-15-0, soluble in ketones, esters, nitroparafines, and the mixture of the latter with aromatic hydrocarbons, (forming solutions of 15-20% concentration) and insoluble in alcohols, turpentine and aliphatic hydrocarbons. The present paper compares atmospheric stability of these two polymer coatings with that of other synthetic resins: alkyd, perchlorovinyl, copolymer of vinyl chloride with vinylidenechloride, mixtures of other synthetic resins: alkyd, perchlorovinyl, copolymer of vinyl chloride with vinylidenechloride, mixtures of the latter with phenolic resins; and with coatings from vegetable oils. The results are tabulated and show the superiority of the vinylchloride-vinylacetate coatings on several counts, which warrants their use on atmosphere-exposed surfaces and on above-surface parts of ships. A good resistance to a 3% NaCl solution was obtained by using a system containing phosphatizing primers. Of the pigments tested, the authors recommend zinc whites, with small addition of carbon black and ultramarine (in some instances also talc).

The Protective Properties of Polyorganosiloxane Enamel No. 9 and Lacquer FG-9.

A. F. Moiseev, M. A. Chinenova. Lakokrasochnye Materialy i Ikh Primenenie, 1960, No. 3, 58-61.

A comparative investigation of the protective behavior of two polyorganosiloxane coatings on sandblasted and phosphatized steel surfaces: FG-9 (a polyphenylsiloxane lacquer) and enamel No. 9 (a mixture of 94 parts by weight of FG-9 and 6 parts of aluminum powder). The tabulated results of artificial, accelerated aging tests are said to be the first comprehensive description of the protective properties of these thermostable organosilicon coatings. The protective characteristics of enamel No. 9 on phosphatized surfaces is 2-2.2 times higher than on sand blasted steel surfaces. The protective properties of lacquer FG-9 on phosphatized steel surfaces is somewhat lower than that of enamel No. 9 on sand blasted surfaces. Two layers of enamel No. 9 offer 1.5 times better protection than a single coat.

Aging of Dispersion Films of Some Vinyl Polymers. (Communication II).

L. F. Korsunskii. Lakokrasochnye Materialy i Ikh Primenenie, 5:11-18 *(October 1960).*

An account of the continued investigation of the rate of change in physico-mechanical properties (elasticity, hardness, crack resistance and elongation) of films based on aqueous dispersions of vinyl polymers (polyvinylacetate, copolymer of 85% vinylacetate and 15% vinylbutyrate, copolymer of 85% vinylacetate and 15% methylacrylate, and polymethylacrylate), under irradiation by a quartz mercury vapor lamp (PRK-2) in atmospheric thermostat at 60°C. from a distance of 45 cm; in conditions of elevated temperatures;

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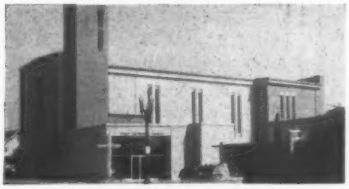

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and also upon aging under a glass roof. The author established that when maintained at conditions of elevated temperature and under a glass roof, the tested vinyl polymers do not convert to a three-dimensional structure; upon irradiation by the PRK-2 lamp, they do so only partially. Under irradiation and action of elevated temperature, dispersion films of these polymers fully retain their physical integrity; on the other hand, oil or casein-oil films exposed to the same conditions undergo partial or complete disintegration. It was shown experimentally that the effect on polymers of 400-500 hours of exposure to temperature of 60°C. is analogous to exposure under a glass roof for the period of one summer season (April-October).—Communication I (*Lakokrasochnye Materialy i Ikh Primenenie*, 1:23, 1960) described the results of a dependence study of physico-mechanical and physico-chemical properties of aequous dispersions of several vinyl polymers on a number of factors.

Synthesis of Yellow and Red Cadmium Lithopones, and their Physico-Technical Properties.

N. S. Rassudova, N. A. Tikhonova, and A. A. Butkute. Lakokrasochnye Materialy i Ikh Primenenie, 5:22-24 (October 1960).

Using a modified method of lithopone synthesis, the authors prepared yellow and red cadmium lithopones ("cadmopones"). In comparison with the more expensive cadmium pigments, cadmopone synthesis utilizes a smaller amount of Gd, while having approximately the same covering power as well as intensity; this relatively high intensity and covering power of cadmopones is the result of their high degree of dispersion and larger specific surface. Red cadmopones in dry powder state differ from their cadmium counterpart by possessing somewhat lower brightness. Since cadmopones, in comparison with cadmium pigments, are equally stable to light and heat, the authors regard them as a suitable substitution in industrial conditions.

A New Method of Drying Paste-Forming Pigments.

P. G. Romankov, N. B. Rashkovskaya, Z. A. Berezovskaya. Lakokrasochnye Materialy i Ikh Primenenie, 1960, No. 3.

The authors describe a method of continuous drying of paste-forming materials (Milori blue, white mineral pigments, lead chromate) in suspension. The equipment, which may be constructed locally, consists of a single-chamber cylindrical-conical drier with an effectiveness of 400-1000 kg/m-/hour evaporated moisture. Since the process permits high temperatures, fuel gases may be employed for pigment drying; the consumption of drying agent is lower than with other driers. Paste-forming pigments, dried in suspension, need no further grinding. The process is suitable for mechanization and automation.

Steric Conversion of BMK-5 Resin.

M. Ya. Sharov, I. I. Denker, and E. P. Kalinina. Lakokrasochnye Materialy i Ikh Primenenie, 5:25-27 (October 1960).

When heated to temperatures exceeding 160°C., the copolymer of butyl methylacrylate and methacrylic acid (resin BMK-5) undergoes, apart from destruction, a transition to a three-dimensional structure. The authors have established that with the addition of a grafting agent (of which the melamine-formaldehyde resin has proved to be most effective), the presence of functional groups permits the conversion to a steric structure already at temperatures of 60°C. The presence of small amounts of melamine-formaldehyde resin not only causes more rapid and fuller transition to three-dimensional structures but it also acts as inhibitor of the destruction processes.

Thermostable Organosilicon Coatings (Literature Review).

A. F. Moiseev, D. Ya Zhidkin, and M. F. Borisov. Lakokrasochnye Materialy i Ikh Primenenie, 1960, 4:35-40.

A literature survey of Soviet and non-Russian investigations concerned with the problems of synthesis, materials, properties, etc. of thermostable polyorganosiloxane polymers, and coatings of their basis.

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(*From page 44*)

manufacturers in recent years, there is no substitute for proper handling after receipt by a resin manufacturer and those who have weak links in their handling operations, such as ordinary steel weighing tanks, are flirting with dark colored resins from time to time.

Advantages of Whole Oils

The advantages of whole oils are many. Being agricultural commodities, the supply is plentiful and the prices are generally low. The methods of refining are relatively cheap and therefore entail only small differentials over the raw or crude oils. The problems of handling are relatively minor since they are non-corrosive; most are liquid and can be pumped easily, therefore heated tanks are unnecessary except for such specialties as coconut oil. About the only handling requirement is that an inert gas blanket should be provided for the highly oxidizable oils if storage is to be lengthy.

With respect to properties and economics, the oils lend themselves best to the very long oil alkyds (i.e. above 60% oil length) since preparation of these alkyds from fatty acids would entail the manufacture of free oil in the presence of the alkyd which certainly would be uneconomical. Then too, many of the long oil alkyds are for trade sales paints and do not require premium speed of dry or the extra slight durability imparted by fatty acids.

In general, it can be said that oil is a very cheap source of glycerol and that, in glycerol type alkyds, fatty acids are seldom used anymore with the probable exception of a few short to medium oil-length alkyds, where considerations such as gloss and speed of baking in industrial finishes are of paramount importance.

Oils are also advantageous when alcoholized with pentaerythritol in the longer oil-length types of 60% oil or greater. However, fatty acids with pentaerythritol or dipentaerythritol get the nod if speed of dry is important because the extra functionality of PE and Di-PE can be likened to an increase in iodine value since extra cross-linking sites are provided along the linear backbone.

Disadvantages of Whole Oils

If oils are used so much, what are their disadvantages? Part of the answer lies in the fact that when something out of the ordinary is desired, the alkyd chemist must look beyond what mother nature puts in the drying oils. For example, since soybean oil contains approximately 6% of linolenic acid, the yellowing of architectural white enamels based on soybean oil modified alkyds can only be retarded to a certain degree by such aids as the use of zinc oxide in the white enamels. On the other hand, for use in premium type architectural white enamels segregated cottonseed fatty acids or mixtures of these acids with distilled low-rosin tall oil acids should get the nod in conjunction with pentaerythritol and do a better job of drying as well as effecting white enamels with superior non-yellowing characteristics.

As mentioned previously, the alcoholysis of whole oil is incomplete and leads to a certain amount of free oil or certainly a small amount of low molecular weight polyesters in the alkyds, both of which are slower drying than uni-

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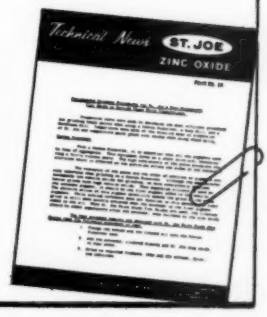

ZNO-176

formly higher molecular weight alkyds prepared from fatty acids.

The last, but not least, disadvantage of oils to be mentioned here is that concerning those oils which have fairly large amounts of palmitic and stearic acids. For some reason palmitic and stearic acid love to join forces with ZnO in architectural white enamels and result in Zn soaps which may produce seeds. One of the solutions to this problem is to use fatty acids which contain little or no saturated acids. The more popular choices today are low-rosin tall oil fatty acids or the segregated cottonseed and soybean fatty acids although safflower oil should not be overlooked in certain areas of the country where it is more economical than the acids just mentioned.

Fatty Acids Vs. Fatty Acids

At this point in our subject, a somewhat controversial note will be introduced i.e. which is better as a diluent for linoleic acid? Palmitic and stearic acids, or oleic acid?

We have a choice of many oils and distilled fatty acids containing these component acids. Some alkyd chemists have argued that palmitic and stearic acids are best for drying because in the pure state they effect hard, waxy alkyds and thus should be considered to add early hardness to a drying alkyd film. On the other hand, oleic in the pure state effects an alkyd which is very tacky and requires as much as a week to dry out of tack. At this juncture it is well to consider the differences in adhesion affected by the saturated acids and oleic acid. On this score oleic acid has very much the upper hand because it contains a double bond in the 18-carbon chain. The palmitic and stearic acids, on the other hand, behave like paraffin wax and tend to lower adhesion. For these reasons the writer leans toward the choice of tall oil and the segregated acids as tools for alkyd formulation when it is desired to obtain better adhesion, color retention and non-seeding.

When is linoleic acid not linoleic acid? One answer is: When you find it in an alkyd which doesn't dry normally. Most of us take for granted what we read in the books concerning the fatty acid composition of vegetable oils. We should until the modern generation comes up with new analyses based on gas chromatography, infrared, ultraviolet and other modern apparatus. But, distilled fatty acids may have no resemblance to the composition of the mother oil from which it was derived.

Let us take the simple case of linoleic acid. Mother nature gives it to us in the form of cis-9, cis-12 octadecadienoic acid. However, it can still exist in seven other forms. Suffice to say, we experienced an unusual result several years ago when a fatty acid supposed to contain 56-60% of cis type linoleic acid caused alkyds to dry like fly paper. Some regular analytical sleuthing using isomerization methods and an ultraviolet spectrophotometer indicated only 38% of cis-cis linoleic acid. An infrared method indicated the missing portion to be 20-22% isolated trans linoleic acid. Publications of the Hormel Institute (4) resolved the mystery of drying since their work on methyl esters of linoleic acids

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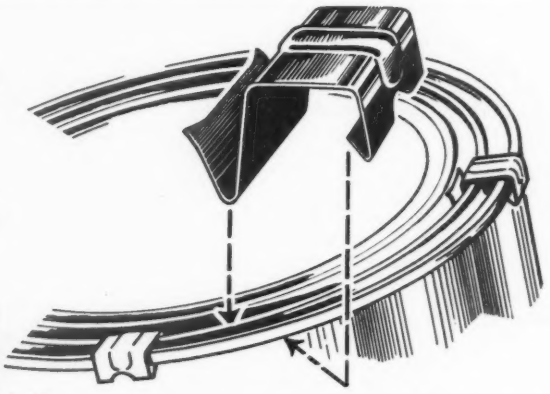

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showed that the trans variety are much slower to oxidize.

How did trans linoleic acid get into these fatty acids? Upon tracing backward by the supplier, it was found that the fatty acid soapstock had been obtained from an oil refinery that also made oleomargarine and shortening and evidently mixed alkali refining soapstock with other odds and ends around the plant of the type which had been in contact with hydrogenation catalysts. In any event the soapstock contained a high percentage of isolated trans linoleic acid which distilled along with the regular cis, cis linoleic acid and escaped quality controls based on simple iodine values.

What should this story mean to the producers of fatty acids. From the viewpoint of the consumer it means that much better quality control must be introduced in order to insure getting what they are paying for in terms of fatty acid composition. We prophesy it will not be long before consumers demand gas chromatography analysis and infrared inspection to guarantee the quality of the fatty acids they buy.

In conclusion, the battle of oils versus fatty acids will continue in the alkyd industry. When economics is foremost and properties and performance are secondary—oils will get the nod. However, in many industrial and trade sales finishes, where speed of dry, adhesion, yellowing, gloss, hardness and other properties are part of the specifications to be met, the fatty acids give the alkyd chemist more freedom of formulation and more chances of success. The fatty acid industry can improve its position by emphasizing quality control and actual composition of the fatty acids they are selling. With information like this, the alkyd chemist should have very little trouble in using fatty acids intelligently.

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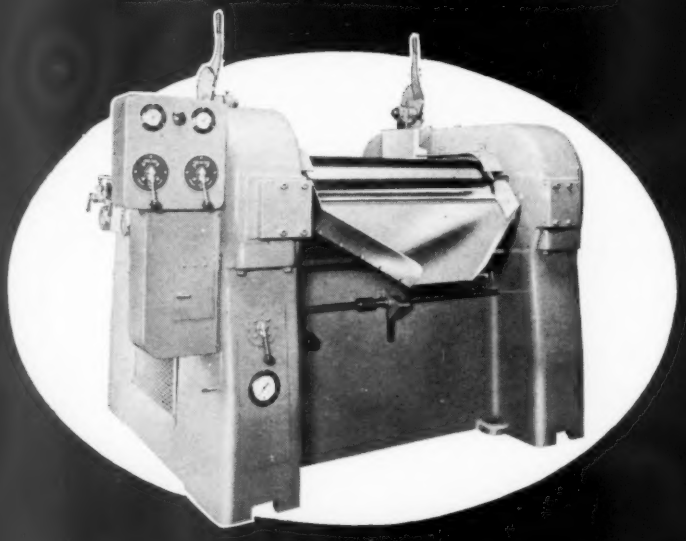

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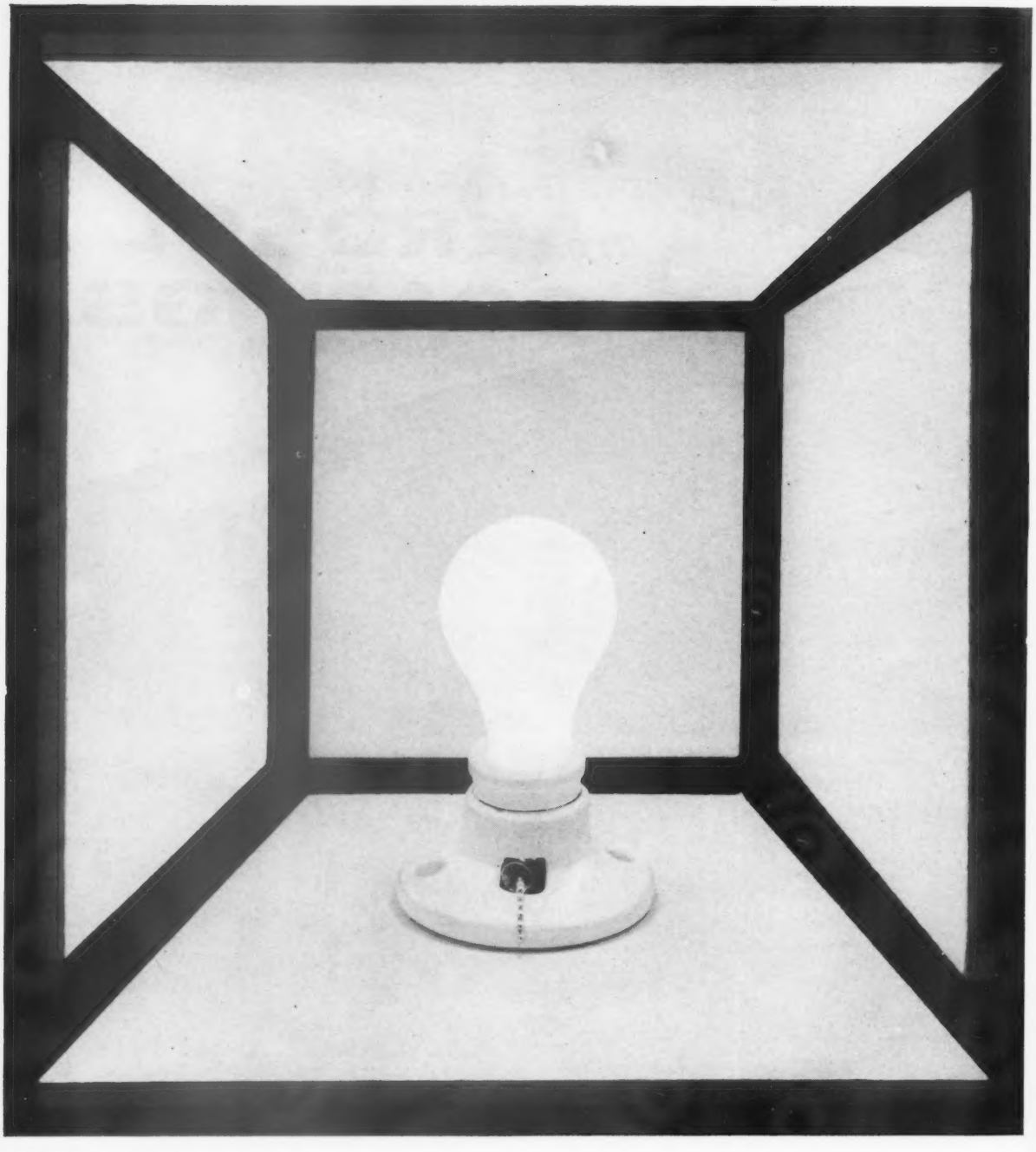
OFF THE PRESS. . .Dean E. Emerson Leuallen of the College o Pharmacy, Columbia U., receives a first copy of the just-publishe book "Aerosols: Science and Technology" from its editor, H. R Shepherd, President of Aerosol Techniques, Inc., Bridgeport, Conn The volume, a comprehensive survey of the pressurized packaging industry, is a collaboration of 19 aerosol authorities. The Columbi college was the first to install an aerosol research laboratory. See p. 10



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ALUMINUM AEROSOL CONTAINERS

By
John J. Sciarra*

THE first aerosol products to be developed were the high pressure insecticides which utilized Propellant 12 (dichlorodifluoromethane) as the propellant. Since these products operated under a relatively high pressure, 75-80 pounds per square inch, a container meeting this rigid requirement was needed. A container was developed by the Westinghouse Electric and Manufacturing Company, consisting of a cylinder made of two shells drawn of 0.044 sheet steel and brazed at the center joint. These containers were tested to withstand 1600 psig. and had a safety valve which would release the pressure at 300 psig. While these containers were utilized in great numbers during World War II, of necessity they were bulky, heavy and expensive. If aerosol products were to be fully developed and used by the consumer, a less costly and more attractive package was needed. In addition these containers were difficult to produce not only under limited production but by mass production as well. This thought initiated intensive research by the various manufacturers of aerosol components and led to the development of low pressure propellants, newer valves which would produce the desired results at these lower pressures, and the lower priced aerosol containers.

*Associate Professor of Pharmaceutical Chemistry, St. John's University, College of Pharmacy, Jamaica 32, New York.

Typical aluminum aerosol containers, 16 ml to 37 ounce capacity.

"Beer Can"

Continental Can Company developed essentially a "beer type" container which could be mass produced and was capable of withstanding these lower pressures. At first the containers were supplied with a valve incorporated into the design of the container and was double seamed onto the container after the product was cold filled into the container. This container consisted of a single flat sheet of tin plate, rolled, and soldered longitudinally, flanged, with concave ends applied by a conventional double seaming operation. Later, one end was formed to a one inch opening with a curled lip which would take the standard one inch valve cup. This type of container is known as the "three piece" container.

Two Piece Container

A "two piece" container was developed by Crown Cork and Seal Company. This container consisted of a one piece drawn metal body and a concave end. These were designed with a valve in one end which was later replaced with the one inch curled opening. The drawn body was made of black iron formed from 100 pound deep-drawn sheet stock by a multiple die drawing process. These containers were capable of holding greater pressure than the "three-piece" container and were less susceptible to failure. However, the container is limited to a 12 ounce or smaller size. Since there is no side seam the container, known as "Spra-Tainer", allowed for continuous all around exterior lithography which greatly improved the appearance of the aerosol product. In addition there was no danger of side seam failure.

Most paint products have been packaged either in a 12 ounce Spra-Tainer or a 16 ounce three piece metal container. These containers have given satisfactory service to date and are in widespread use.

Aluminum Container

Recently, extruded, one piece aluminum containers have been introduced in this country. They have been available since 1954 in a 2¼ ounce size. These containers are extruded in one piece and then the open end is curled inward to form the one inch opening. Since this container has no seams it is capable of withstanding exceptionally high pressures as compared to the other types of aerosol containers. It also allows for external lithography resulting in an attractive package. Since the size of the finished container is dependant upon the amount of starting material, the container can be made in sizes from about 16 ml to 37 ounces. Recently, the Monobloc Aerosols, Ltd., Company announced aluminum containers in sizes from 16 to 110 ounces (water weight). By varying the thickness of the wall, the containers can be made to withstand pressures in excess of 500 psig. although present Interstate Commerce Commision regulations allow for the shipment of certain of the liquefied gas products (under special permit) up to 150 psia pressure at 70°F and up to 300 psia of non-liquefied compressed gas at 70°F depending upon the pressure rating of the container.

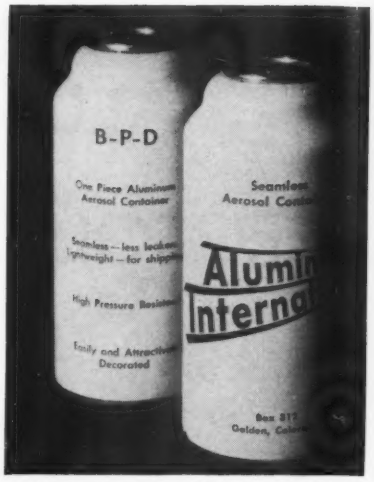
While it is highly unlikely at this time that these excessive pressure are required for the dispensing of paint and related products it might be well to investigate the use of aluminum containers for aerosol paint products.

Paint products packaged in aluminum containers would possess the following advantages:

1. No danger of leakage of the product through the container since there are no side seams or ends which have been seamed onto the container.

2. In certain cases, corrosion has been found to take place on the side seam stripe and around the ends of the container where the top and bottom portions have been seamed in place. It has been difficult to apply protective coating to these hard to reach places. This is overcome in aluminum containers.

3. Shipping weights are reduced since aluminum is considerably lighter than tin-plated steel. For example a conventional three-piece, tin-plated steel 16 ounce container weighs about 105 grams while a 18 ounce aluminum container weights about 60 grams and a 35 ounce aluminum container weights about 115 grams. These weights would vary somewhat depending upon internal coatings and external lithography although these would be about the same in both cases. Thicker walled containers would be heavier.



One piece, seamless aluminum aerosol container resists high pressures.

4. Products which show a preferential attack on steel may not show this attack on aluminum and therefore may result in newer aerosol products. It is believed that it is in this category that aluminum containers would serve to best advantage.

5. Conventional coatings can be applied to aluminum containers as well as to tin-plated steel containers although the operation is a little more difficult.

Cost Considerations

Aluminum containers are more expensive than the conventional tin-plated steel containers, however, it is believed that when they are in full production and a greater use of such containers is made, the price would be considerably reduced. The base price of an 18 ounce aluminum container is about 13 to 20 cents each while a 12 ounce container is about 9-12 cents depending upon quantity purchased. This does not include the various coatings or cost of lithographing the containers. These other costs might add up to an additional 2 to 8 cents per can depending upon the additional requirements. These are approximate costs and it is possible that they will be considerably reduced in the near future. These prices are for an imported container and may be slightly higher than ones made in this country. Several concerns in this country are now producing aluminum containers up to the 12 ounce size. It has been announced

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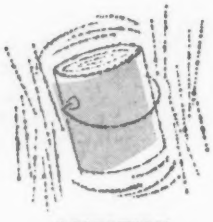

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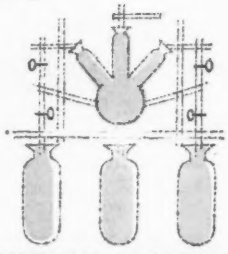

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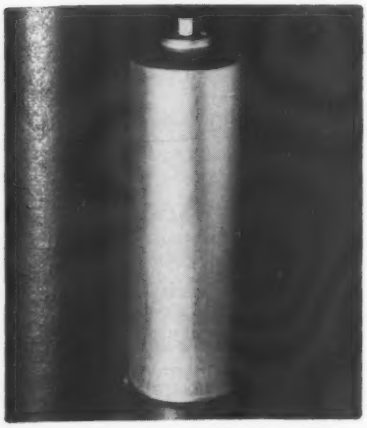


24-ounce aluminum aerosol container offered by the Continental Can Co.

that 16 ounce containers will be in production in the near future.

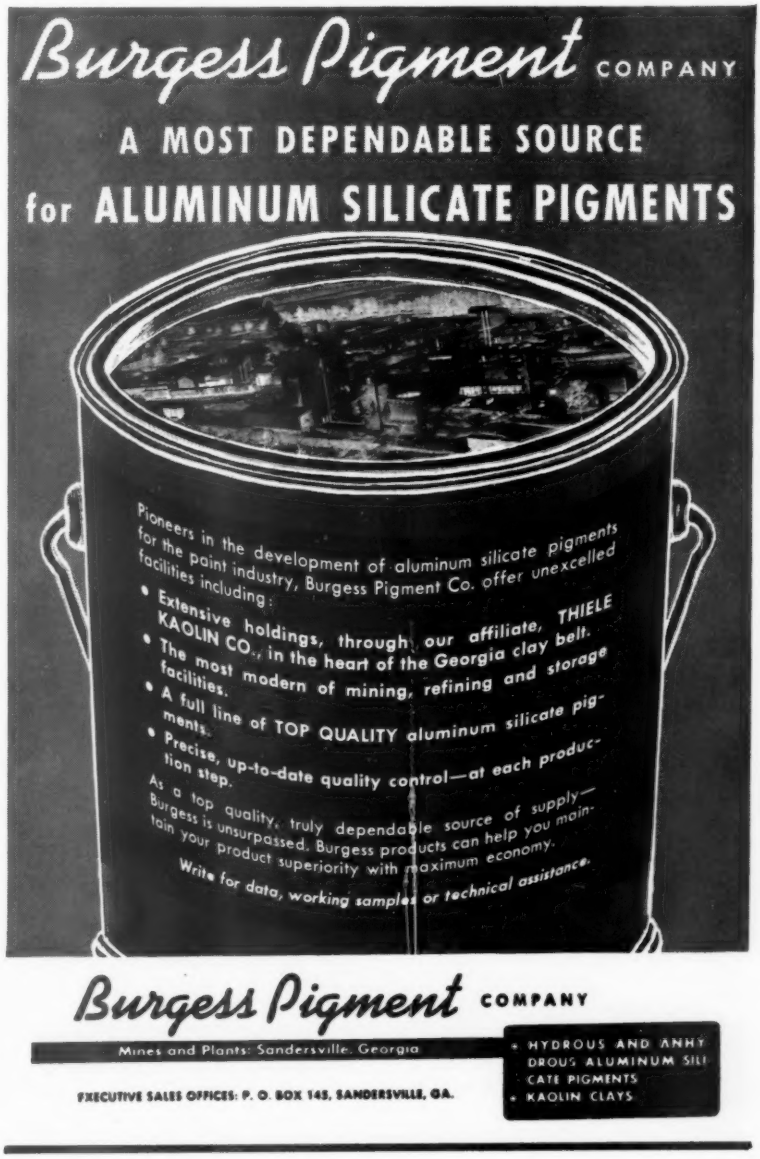
Aerosol Applications

Aluminum is an extremely reactive metal and due to its amphoteric nature is attacked by both alkaline and acidic substances. However, the formation of a continuous film of aluminum oxide produces a high degree of chemical inertness. This film is easily reformed in the presence of oxygen and water vapor and it is for this reason that aluminum is resistant to atmospheric corrosion. While in most aerosol tin-plate steel containers, the air is evacuated to prevent corrosion, it is possible that this practice may hasten the breakdown of an aluminum container. It is in this respect that all formulations must be throughly tested before it is finally packaged in an aluminum container. For some products there may not be a need for any further treatment of the aluminum surface while other products may require an organic coating of an enamel, vinyl, phenolic or epoxy type system. The choice of system used will depend upon the product to be packaged in the aerosol container. As many as four coats of an epoxy type enamel has been used. This coating has excellent flexibility and adhesive properties. Generally a double coated system will suffice.

For perfumes and essential oil products, a second enamel system of a phenolic-base coating is required. These are generally odorless, tasteless and non-absorptive although not as flexible as other type coatings. This can be modified by the addition of suitable plasticizers. Vinyl top coats seem to work very well for water-base formulations. Additional research is indicated in this area. Many different type resins have been investigated as to their application for products which may be extremely damaging to the container. Some of these have shown promising results. Others have investigated the possibility of using a "rubber" base coating. This has been used to a limited extent in Europe and its use is being investigated.

Another application for an aluminum aerosol container is the piston-type container. While it is highly unlikely that this container will find use in the aerosol paint industry, the knowledge of its availability may lead to its use. One of the problems associated with the formulation of several types of aerosol products was the incompatibility associated between product concentrate and propellant. Many ways were devised in order to separate these two components but the only one showing signs of success is the piston-type container.

This container consists of a impact extruded body, the bottom of which is fitted with a self-sealing rubber valve. Placed into the container is a plastic, rubber or aluminum plate which acts as a piston.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The dispensing valve is attached to the top of the container. These cans are filled by adding the product concentrate through the top and sealing the valve in place. Then a few grams of liquefied gas propellant is added and the rubber valve is inserted. The propellant gas expands and pushes against the piston. When the valve is depressed, the piston forces some of the product out of the container valve. Incertain cases, the liquefied gas can be replaced by a compressed gas. This type of container is especially suited for viscous products such as creams, tooth pastes, and may be applicable to some of the paint products such as coloring oils, pigments etc. where added protection to atmospheric oxygen and from drying out is afforded by this type of container.

Aluminum aerosol containers have been available for many years but due to a lack of interest on the part of the potential users, little or no research was done. Recently, need arose for the availability of a newer container due to some of the limitations posed by the more conventional containers. At this writing it seems that aluminum aerosol containers may offer answers to some of these limitations. As our technology increases in these areas newer and better products will evolve. Only time will tell the role that aluminum containers will play in the paint industry. Research into this can as a packaging media may well result in a multitude of products appearing on the dealers shelves having consumer appeal.

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Suppliers of Aluminum Containers

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2. Victor Metal Products Corp., Newport, Arkansas
3. Peerless Tube Corp., Bloomfield, N. J.
4. Bradley Sun Div. American Can Co., Hillside, N. J.
5. Continental Can Co., N. Y., N. Y.
6. White Metal Manufacturing Co., Hoboken, N. J.
7. A. H. Wirz, Inc., Chester, Pa.
8. Pegasus International Corp., N. Y.
9. Monobloc Aerosols, Ltd., Bromley, England.

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Aerosol Developments

Aerosol Book Published

Aerosols: Science and Technology, a 562-book on the science and technology of aerosols has been published. The aerosol volume has been planned to fill the current need for a single comprehensive volume which collects and surveys this information—the industrial and technological developments which have taken place during the short history of aerosols and which are now in practice in the modern aerosols industry—and which provides practical information on the problems which invariably accompany a new technology.

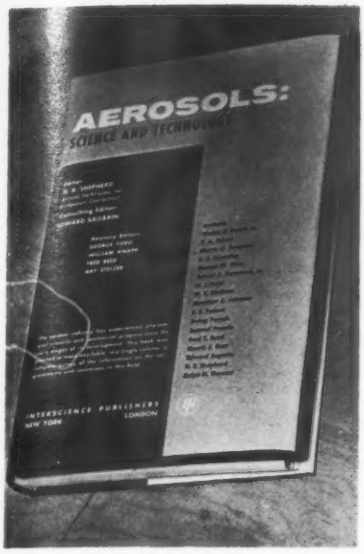
To accomplish the task of bringing together and summarizing a great amount of material from many sources, the editor has enlisted the aid of a group of aerosol experts as contribution authors and as consultants in the preparation of the book. Each chapter is therefore a comprehensive and up-to-date treatment of the developments and the problems of a specific area of the industry written by one who is most familiar with them, expertly arranged in the book for a logical and integrated presentation of the technology of all phases of the entire industry. The material describing the various phases of manufacturing operations, containers, valves, and other components, is followed by the discussion of the many applications of aerosols and the important factors in each case.

Aerosols: Science and Technology will be essential not only to chemists and chemical engineers working in aerosol research, development, and production, but also to those engaged in the marketing of aerosol products and to executives who must have a broad knowledge of all facets of this important industry.

Priced at $22.50, it has the following editors and contributors:

Walter C. Beard, Jr., Risdon Manufacturing Co., Inc.

F. A. Bower, E. I. du Pont de Nemours & Co., Inc.



Martin G. Brookins, Revlon, Inc.
Ralph C. Downing, E. I. du Pont de Nemours & Co., Inc.
George W. Fiero, Esso Standard Oil Co., Inc.
Robert A. Foresman, Jr., Aerosol Consultant
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Samuel Prussin, Aerosol Techniques, Inc.
Fred T. Reed, E. I. du Pont de Nemours & Co., Inc.
Morris J. Root, George Barr and Co.
Edward Sagarin, Embassy Laboratories, Inc.
H. R. Shepherd, Aerosol Techniques, Inc.
Ray Stetzer, Revlon, Inc. and
Ralph H. Thomas, Bristol-Myers Co., Inc.

Book may be purchased from Interscience Publishers, Inc., 250 5th Ave., New York 1, N. Y.

Kartridg Pak Announces Small Aerosol Packaging Line

New compact line developed by Kartridg Pak, Mount Prospect, Ill., with a capacity of more than 400,000 units annually, can be installed together with necessary auxiliary equipment for under $6,000. The relatively small investment will allow marketers to do their own packaging with their present labor and overhead. The unit consists of a concentrate filler, crimper for standard 1" valve, and propellent pressure filler with accumulator and propellent handling pump, mounted on a stainless steel table in a 30" x 6' floor space.

Code-Dating Booklet Published

A 12-page booklet, "The Mechanics of Initiating and Maintaining a Successful Code-Dating System," has just been issued by Adolph Gottscho, Inc., makers of automatic coding and imprinting machines. The booklet details the various advantages of coding packaged products, and describes various tested coding structures. Sample coding methods suitable for various types of products are given, together with a discussion of the mechanical application of codes in different situations.

A free copy may be obtained by writing Adolph Gottscho, Inc., Hillside 5, N. J.

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NEWS

Oxo Plans Plant

Oxo Chemicals Co. plans to construct a multimillion pound per year isooctyl and decyl alcohol plant at Haverhill, Ohio.

The plant will occupy about twenty acres of a much larger company-owned site fronting on the Ohio River. Dock facilities will be built on the river to permit shipment of raw materials and finished products by water.

Construction will be started this Spring, with completion scheduled for early 1962.

Heyden Newport Launches New Mexican Venture

Heyden Newport Chemical Corp., New York City, has just begun the production and sale of a line of industrial chemical additives made in Mexico through its newly-formed Nuodex Mexicana, S. A., it was announced.

Initial production, from manufacturing facilities in Mexico City, is concentrating on chemicals made and sold in the United States by Nuodex Products Division and in 12 other nations by Nuodex licensees.

The Mexican line will include Nuodex paint additives and nickel chemicals, including naphthenate paint driers; Nuact Paste, a paint loss-of-dry inhibitor; and nickel sulphate and nickel carbonate.

Montecatini to Grant Fellowship for Italian Study

Montecatini Soc. Gen., Milan, Italy, announced through the American-Italy Society, that it is offering a $3600 fellowship for a year's study on high polymers at the Polytechnic Institute of Milan. Recipient of the fellowship will study under the direction of Professor Giulio Natta, Director of the Institute of Industrial Chemistry and world-renowned high polymer chemist who discovered isotactic polymers.

The fellowship, covering the academic year September, 1961 through June, 1962, will be administered by the America-Italy Society. To be eligible, applicants should have completed some graduate studies in chemistry but the competition is also open to outstanding undergraduate students who will be awarded a Bachelor's degree by June, 1961. A working knowledge of Italian is necessary by the time the fellowship becomes effective.

Applicants will be evaluated by representatives of the Institute of International Education and the America-Italy Society, with Montecatini acting in an advisory capacity. Qualified applicants should submit a detailed resume to the America-Italy Society, 22 E. 60th St., New York City, N. Y.

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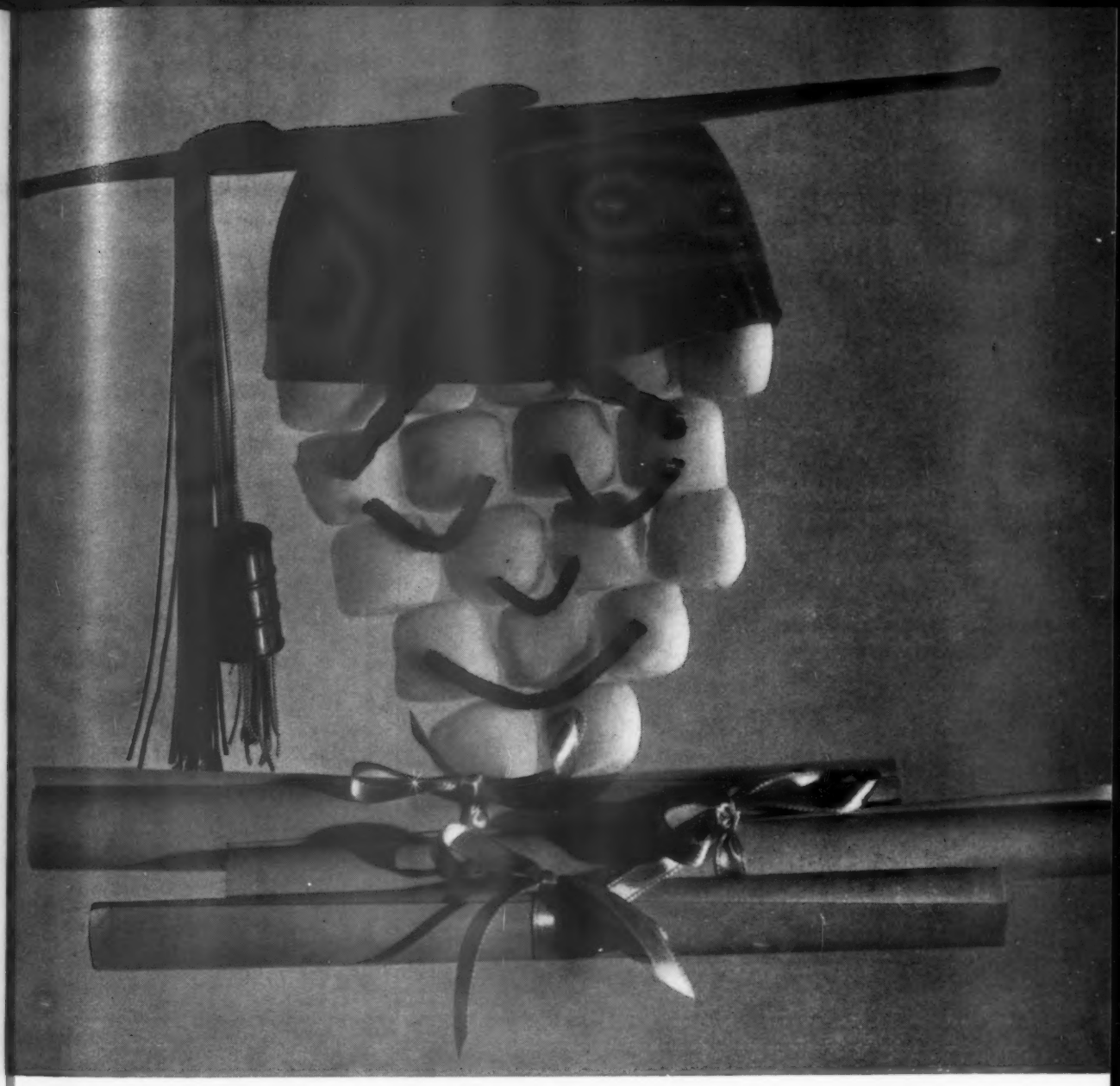
Gaily illustrated children's T-shirts bearing the slogan, "I'm Daddy's Paint Partner" are featured in the Martin-Senour Paint Co.'s spring promotion plans. The back of the shirt can be left blank or imprinted with dealer's own artwork or name.



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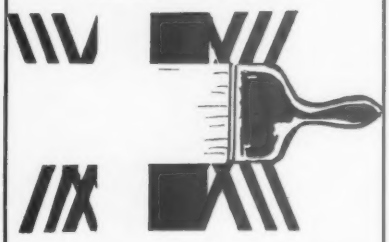

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NEWS

Cabot to Construct Argentine Carbon Black Plant

Cabot Corp., Boston, Mass., one of the world's largest manufacturers of carbon black, has announced it has received authorization from the Argentine Government for the immediate construction of a 30 million pound per year carbon black plant in Argentina, by its subsidiary, Cabot Argentina S.A.I.C.

The plant will produce the complete range of oil furnace blacks and will employ about 70 to 80 Argentines. It will be completely equipped with modern analytical, quality control and rubber testing laboratories, and will also utilize facilities of the parent company for basic technical assistance and for carbon black research and development work.

Carbon black is used extensively (97% of world's total production) for the reinforcement of all types of rubber products, including truck, bus and passenger car tires. The oil types of furnace blacks to be manufactured at Campana will supply optimum wearing properties, particularly to synthetic rubber. Carbon blacks are also used for coloring purposes in paints, inks, plastics, and for special applications in miscellaneous other products.

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May 1-3. Thirty-fourth Annual Meeting of the American Oil Chemists' Society. Sheraton-Jefferson Hotel, St. Louis, Mo.

May 5-6. Southwestern Paint Convention of the Dallas and Houston Societies for Paint Technology, Houston, Tex.

May 18-20. Southwestern Paint Convention of the Dallas and Houston Societies for Paint Technology, Houston, Tex.

May 26-27. Fourteenth Annual Spring Symposium of The Pacific Northwest Paint & Varnish Production Club. Hotel Georgia. Vancouver, B. C.

June 2-3. Annual joint meeting of the Kansas City and St. Louis Societies for Paint Technology, Kansas City, Mo.

June 5-9. Plastics Exposition Sponsored by the Society of the Plastics Industry, New York Coliseum.

June 20-27. 6th Paint Short Course for High School Chemistry Teachers University of Missouri School of Mines and Metalurgy, Rolla, Mo.

Oct. 30-Nov. 1. Seventy-fourth Annual Meeting of the National Paint, Varnish and Lacquer Assn. Statler-Hilton Hotel, Washington, D. C.

Oct. 30-Nov. 1. Fall Meeting of the American Oil Chemists Society, Pick - Congress Hotel, Chicago, Ill.

Oct. 30-Nov. 1. 4th Annual Meeting and Conference of the Canadian Mfrs. Specialties Assn., Royal York Hotel, Toronto, Canada.

Nov. 2-4. Annual Convention of the Federation of Societies for Paint Technology. The Shoreham and Sheraton-Park Hotels, Washington, D. C.

November 26-28. Fourteenth Annual Convention and Trade Show of the Retail Paint & Wallpaper Distributors of America at Cobo Hall, Detroit, Mich.

December 4-6. Chemical Specialties Mfrs. Assn., 48th Annual Meeting, New York City.

NEWS

FMC'S New Epoxies Enter Semi-Commercial Production

Food Machinery and Chemical Corp. has announced that production of its new Oxiron resins has been expanded to semi-commercial status.

Multi-drum quantities of these materials, which are epoxidized polyolefins rather than epichlorohydrin-based condensates, are now available from the company's Baltimore plant.

The new plant directly epoxidizes olefinic raw materials with hydrogen peroxide utilizing unique *in situ* epoxidation processes developed and patented by the firm.

The plant is capable of producing FMC's other epoxy chemicals as well as Oxiron resins. These include currently available octylene oxide, dodecene oxide, C_{16}-C_{18} olefin oxide, limonene monoxide, pinene oxide, dicyclopentadiene dioxide, and limonene dioxide, plus a number of other new materials scheduled for introduction. Design studies are now underway for the establishment of a large-scale commercial plant to meet future demands for these materials.

Oxiron resins were introduced last January. They differ from conventional epoxies in molecular structure, reactivity, and end properties, and are being examined closely for many new applications in the fields of laminates, castings, adhesives, and surface coatings. Their unique properties and economies give promise of penetration of a number of major application areas not previously open to epoxy resins.

Synthetic Products, Inc. Announces Research Center

Synthetic Products, Inc. formerly of Morristown, N. J. has just completed a new research and development center.

The new center, located at 20 DeForest Ave., Hanover, N. J., includes a new main office, expanded laboratory facilities and a product development reactor, capable of yielding 500 gallon batches.

Allied Chemical Doubles Succinic Anhydride Capacity

Allied Chemical Co.'s National Aniline Div. will double its succinic anhydride production capacity with the start-up of an additional plant at Buffalo, N. Y.

Succinic anhydride capacity has been increased, to meet the growing demand which was spurred by a price reduction last July. The demand for succinic anhydride has reportedly been so great that the product has been on allocation up to now. But with the capacity increase, succinic anhydride is readily available in unlimited quantities. Presently, National Aniline is the only domestic producer of succinic anhydride.

Dominion Tar Awards Fluid Bed Phthalic Contract

Dominion Tar and Chemical Co., Ltd., has approved plans for building a new 22-million-pound-year phthalic anhydride plant adjacent to its present facilities in Toronto. The plant, to cost approximately $3.5 million, will be engineered and constructed by Canadian Badger Co., Ltd., Toronto.

Phthalic anhydride is used principally in the manufacture of alkyd resins for paints, varnishes and lacquers, as well as in the molding of glass-fibre reinforced plastic products. The new plant will use the fluid bed process, which permits lower engineering and operating costs.

A Reichard-Coulston Technical Report

. . . for manufacturers of industrial and trade sales enamels.

Important, new facts about Reichard-Coulston's chemically manufactured synthetic iron oxides—products of extremely fine and uniform particle size.

The problem: to develop pigments of such fine and uniform particle size that grinding time would be minimized. The solution: a series of chemically manufactured synthetic iron oxides—our SOFTEX reds and IROX reds and yellows.

To test these products for ease of grind, one shade of each series was used to produce commercial grade enamels on laboratory-type, 3-roller and high-shear mills. A standard paste grind procedure was used on the roller mill. A conventional high-solvent, low-solids vehicle system on the high-shear mill. (Other conventional milling equipment produces comparable results).

The findings are reported in the chart below.

Using one of these three Reichard-Coulston products, or any of the more than 27 shades of our chemically manufactured synthetic iron oxides, could save you many dollars in production costs, many hours of production time.

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TABLE OF FINDINGS—Reichard-Coulston Synthetic Iron Oxide Pigments Test

Particle Size Distribution	IROX Yellow "207" ED 98% below 1 micron	IROX Red "1360" 98% below 1 micron	SOFTEX Red "1400" 100% below 1 micron
Andreasen Pipette Particle Size Distribution			

(All formulae shown in pounds used)	Roller Mill 1 pass—7 grind			High-Shear Mill 12 minutes—6½ grind		
Batch Formula (Baking finish 100 gallon yield)						
IROX Red "1360"	100			100		
SOFTEX Red "1400"		100			100	
IROX Yellow "207" ED			150			150
Urea formaldehyde 50% NV	140	140	191.1			
Soya alkyd 50% NV				15	15	15
Xylol			23.4	74	74	109.0
Wetting Agent				0.37	0.37	0.37
Reduce						
Urea formaldehyde 50% NV	54.3	54.3	—	196	196	196
Soya alkyd 50% NV	447.0	447.0	437.4	434	434	434
Xylol	166.0	166.0	138.6	92.5	92.5	57.5

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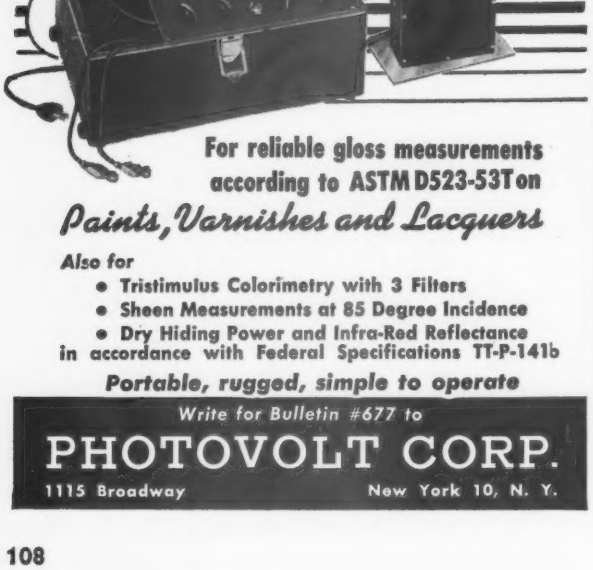

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